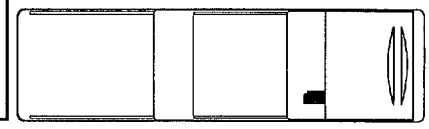
PIONEER®
The Art of Entertainment
SAAB

Service Manual



ORDER NO.
CRT1929

MULTI-COMPACT DISC PLAYER

CDX-M2516ZSA WL

COMPACT disc DIGITAL AUDIO

- **See the separate manual CX-652(CRT1857) for the CD mechanism description, disassembly and circuit description.**
- **The CD mechanism employed in this model is one of CX-652 series.**

VEHICLE	DESTINATION	PRODUCED AFTER	SAAB PART No.	ID No.	PIONEER MODEL No.
SAAB 9000, 900	WORLD	1997	4617072	———	CDX-M2516ZSA/WL

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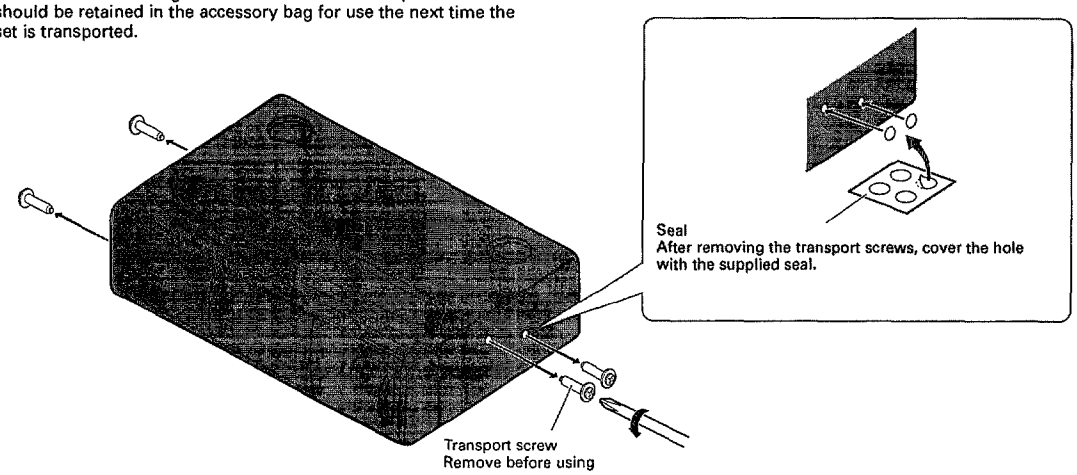
● CD Player Service Precautions

1. For pickup unit(Service)(CXX1235) handling, please refer to"Disassembly"(CX-652 Service Manual CRT1857).
   During replacement, handling precautions shall be taken to prevent an electrostatic discharge(protection by a short pin).
2. During disassembly, be sure to turn the power off since an internal IC might be destroyed when a connector is plugged or unplugged.
3. Please checking the grating after changing the PU unit.
4. Since these screws protects the mechanism during transport, be sure to affix it when it is transported for repair, etc.

Transport screws

A transport screw has been attached to the set in order to protect it during transportation. After removing the transport screws, cover the hole with the supplied seal. Be sure to remove the transport screw before mounting the set. The removed transport screw should be retained in the accessory bag for use the next time the set is transported.



1. SAFETY INFORMATION

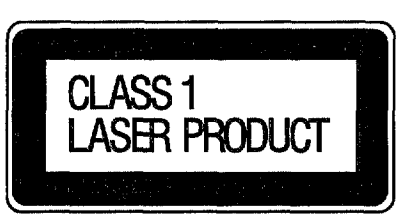
1. Safety Precautions for those who Service this Unit.

- **Follow the adjustment steps (see pages 28 through 36)in the service manual when servicing this unit. When checking or adjusting the emitting power of the laser diode exercise caution in order to get safe, reliable results.**

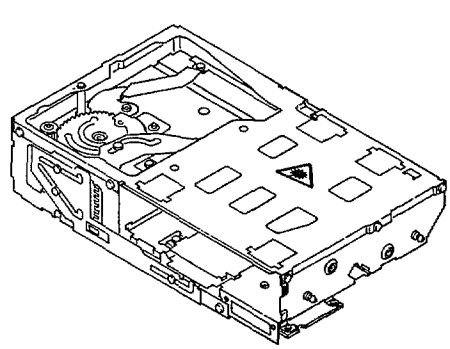
Caution:

1. During repair or tests, minimum distance of 13cm from the focus lens must be kept.
2. During repair or tests, do not view laser beam for 10 seconds or longer.

2. A "CLASS 1 LASER PRODUCT" label is affixed to the rear of the player.



3. The triangular label is attached to the mechanism unit frame.



4. Specifications of Laser Diode

Specifications of laser radiation fields to which human access is possible during service.
Wavelength = 785 nanometers
Radiant power = 69.7 microwatts(Through a circular aperture stop having a diameter of 80 millimeters)
0.55 microwatts(Through a circular aperture stop having a diameter of 7 millimeters)

2. EXPLODED VIEWS AND PARTS LIST

2.1 PACKING

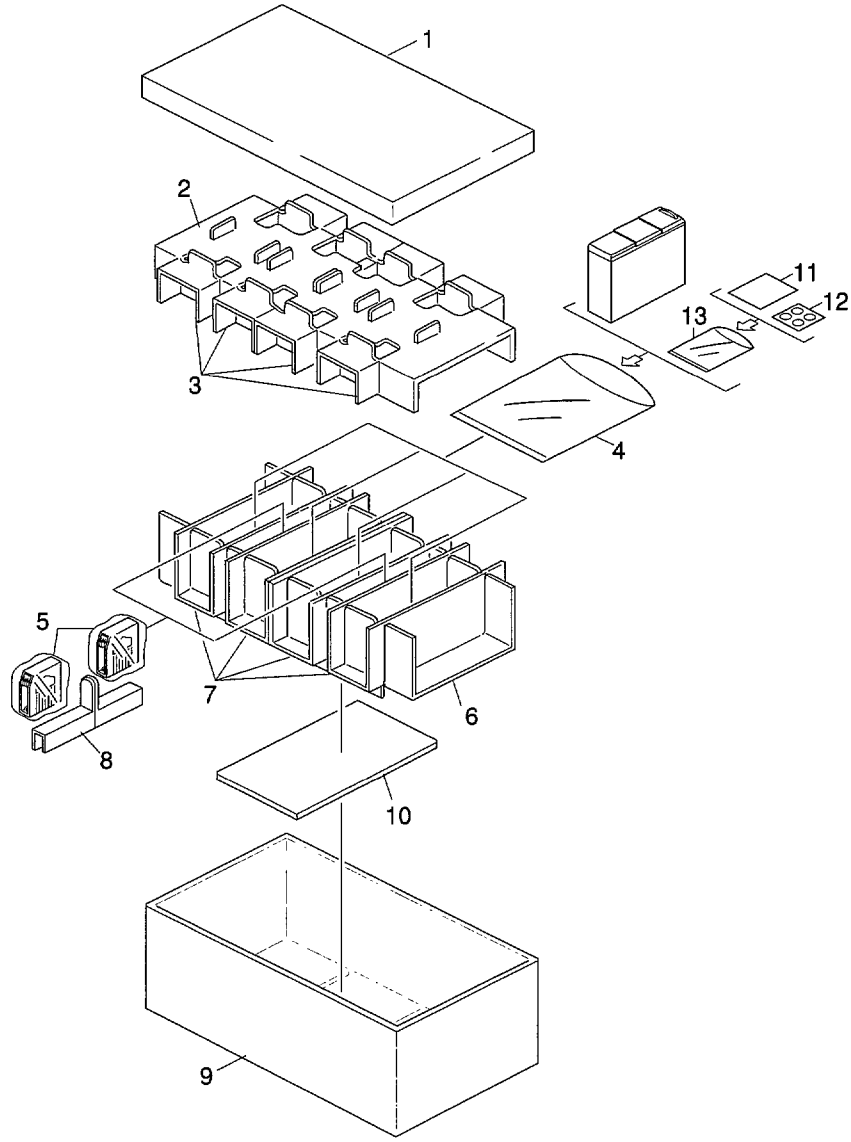


Fig.1

NOTE: Parts marked by "＊"are generally unavailable because they are not in our Master Spare Parts List.

● **Parts List**

Mark	No.	Description	Part No.
	1	Cover	CHW1584
＊	2	Protector	CHP1894
	3	Protector	CHP1864
	4	Polyethylene Bag	CEG1042
	5	Magazine Assy	CXB1091

Mark	No.	Description	Part No.
	6	Protector	CHP1861
	7	Protector	CHP1862
	8	Protector	CHP1863
	9	Contain Box	CHL3100
	10	Board	CHW1571
＊	11	Caution Card	CRP1090
	12	Seal	CNM4918
＊	13	Polyethylene Bag	CEG1099

2.2 EXTERIOR

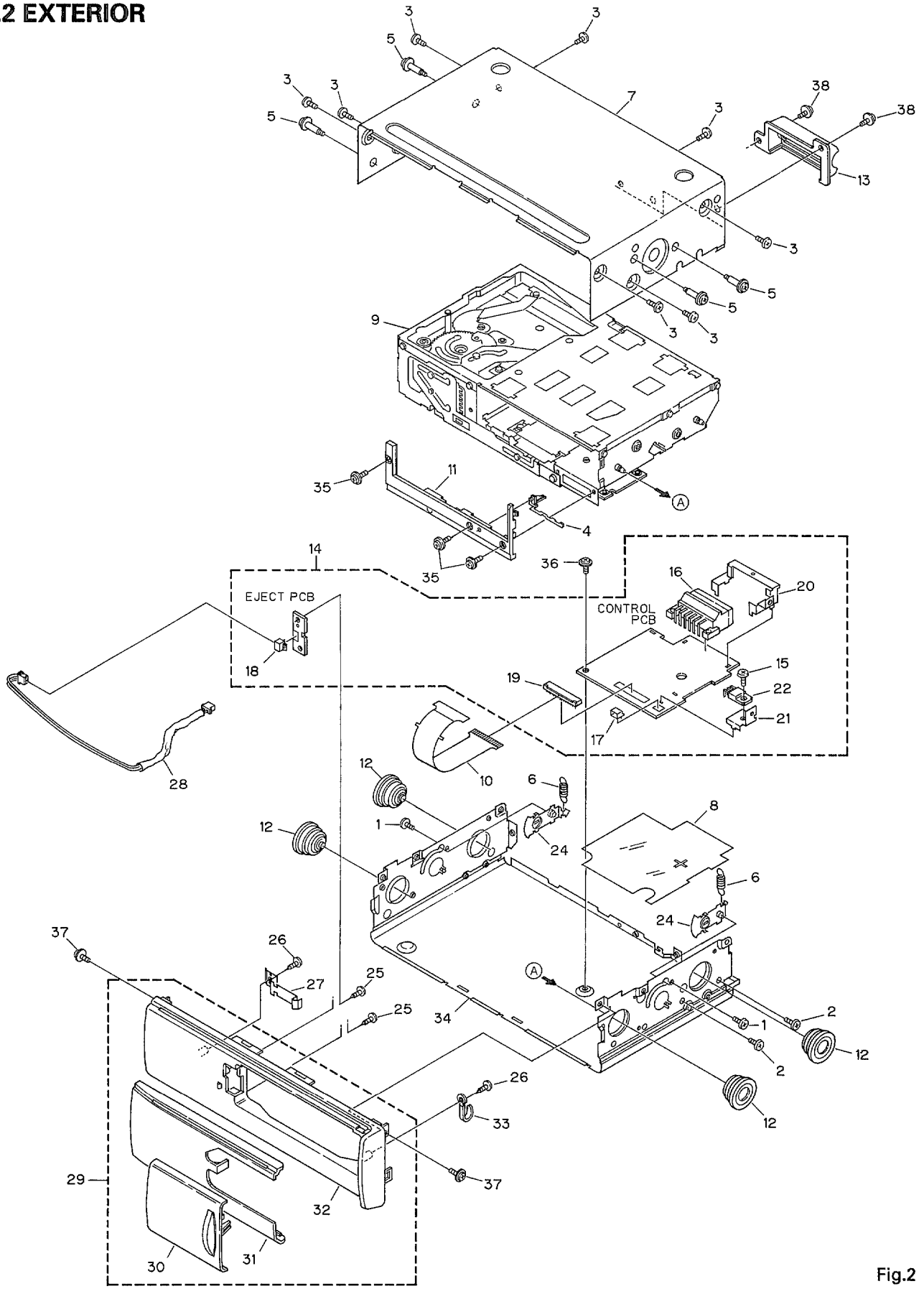


Fig.2

● Parts List

Mark	No.	Description	Part No.
	1	Screw	BMZ20P040FMC
	2	Screw	BMZ26P040FMC
	3	Screw	BMZ30P040FZK
	4	Button	CAC4786
	5	Screw	CBA1353
	6	Spring	CBH1874
	7	Upper Case	CNB2042
	8	Insulator	CNM4701
	9	CD Mechanism Module	CXK4450
	10	PCB	CNP4402
	11	Grille	CNS4055
	12	Damper	CNV4502
	13	Cover	CNV4512
	14	Extension Unit	CWX1983
	15	Screw	BMZ26P050FMC
	16	Plug(CN1901)	CKM1233
	17	Plug(CN1902)	CKS1050
	18	Plug(CN1903)	CKS1050
	19	Connector(CN1701)	CKS2233
	20	Holder	CNC6393
	21	Holder	CNC6672
	22	Transistor(Q1902)	2SB1335A
	23	•••••	
	24	Arm Unit	CXA8606
	25	Screw	BPZ20P060FMC
	26	Screw	BPZ26P080FMC
	27	Spring	CBL1320
	28	Cord Assy	CDE4925
	29	Grille Unit	CXA8769
*	30	Door	CAT1746
	31	Door	CAT1792
*	32	Grille	CNS4140
	33	Clamper	HEF-102
	34	Lower Case Unit	CXA8765
	35	Screw	IMS20P035FZK
	36	Screw	IMS26P040FMC
	37	Screw	IMS30P040FMC
	38	Screw	IMS30P060FZK

2.3 CD MECHANISM MODULE

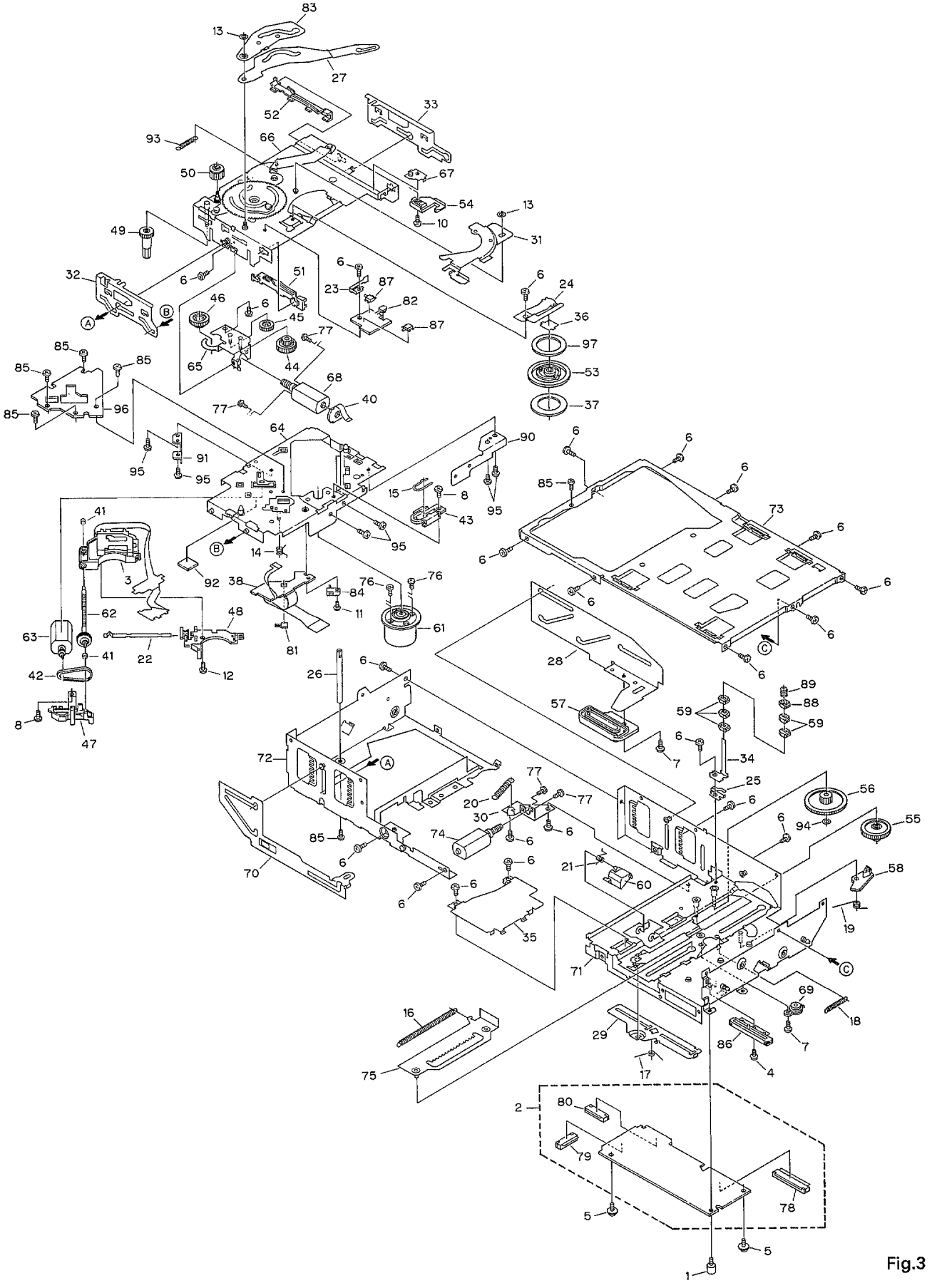


Fig.3

● Parts List

Mark	No.	Description	Part No.
	1	Screw	CBA1369
	2	CD Core Unit	CWX2000
	3	Pickup Unit(Service)	CXX1235
	4	Screw	JFZ17P020FNI
	5	Screw	IMS26P040FMC
	6	Screw(M2X2.5)	CBA1037
	7	Screw(M2X2.5)	CBA1077
	8	Screw(M2X2.5)	CBA1085
	9	•••••	
	10	Screw(M2X4)	CBA1176
	11	Screw(M2X6)	CBA1229
	12	Screw(M2X4)	CBA1362
	13	Washer	CBF1002
	14	Spring	CBH1822
	15	Spring	CBH1948
	16	Spring	CBH1826
	17	Spring	CBH1827
	18	Spring	CBH1828
	19	Spring	CBH1829
	20	Spring	CBH1830
	21	Spring	CBH1919
	22	Spring	CBL1241
	23	Spring	CBL1242
	24	Spring	CBL1249
	25	Spring	CBL1295
	26	Shaft	CLA2803
	27	Arm	CNC6181
	28	Lever	CNC6191
	29	Lever	CNC6194
	30	Bracket	CNC6292
	31	Lever	CNC6534
	32	Lever	CNC6535
	33	Lever	CNC6536
	34	Holder	CNC6538
	35	Cover	CNC6657
	36	Spacer	CNM4879
	37	Sheet	CNM5118
	38	P.C.Board	CNP4205
*	39	P.C.Board	CNP4537
	40	P.C.Board	CNP4382
	41	Bearing	CNR1423
	42	Belt	CNT1053
	43	Plate	CNV4761
	44	Gear	CNV4403
	45	Gear	CNV4404
	46	Gear	CNV4406
	47	Cover	CNV4411
	48	Holder	CNV4412
	49	Gear	CNV4416
	50	Gear	CNV4417

Mark	No.	Description	Part No.
	51	Rail(White)	CNV4419
	52	Rail(Black)	CNV4420
	53	Clamper	CNV4421
	54	Lever	CNV4422
	55	Gear	CNV4423
	56	Gear	CNV4827
	57	Rack	CNV4828
	58	Arm	CNV4426
	59	Guide	CNV4597
	60	Arm	CNV4670
	61	Motor Unit(C5)(M851)(Spindle)	CXA9371
	62	Screw Unit	CXA9130
	63	Motor Unit(C5)(M854)(Carriage)	CXA9131
	64	Chassis Unit	CXB1245
	65	Bracket Unit	CXA9134
	66	Chassis Unit	CXA9137
	67	Plate Unit	CXA9138
	68	Motor Unit(C5)(M853)(Tray)	CXA9139
	69	Damper Unit	CXA7714
	70	Lever Unit	CXA9141
	71	Magazine Holder Unit	CXA9143
	72	Frame Unit	CXA9144
	73	Frame Unit	CXB1108
	74	Motor Unit(C5)(M852)(ELV)	CXA9146
	75	Lever Unit	CXA9147
	76	Screw	JFZ17P020FNI
	77	Screw	JFZ20P025FNI
	78	Connector(CN701)	CKS1968
	79	Connector(CN801)	CKS3484
	80	Connector(CN101)	CKS3486
	81	Photo-Transistor(Q851)	PT4800
	82	LED(D851)	CN504-2
	83	Arm	CNC6799
	84	Switch(S853)	CSN1012
	85	Screw(M2X2.5)	CBA1041
	86	Volume(VR801)	CCW1021
	87	Switch(S851,852)	CSN1033
	88	Guide	CNV4722
	89	Spring	CBH1033
	90	Holder	CNC6819
	91	Holder	CNC6827
*	92	Sheet	CNM5020
	93	Spring	CBH1931
	94	Washer	CBF1038
	95	Screw(M2X2)	CBA1250
	96	Panel	CNC7076
	97	Plate	CNC6847

2.4 MAGAZINE ASSY

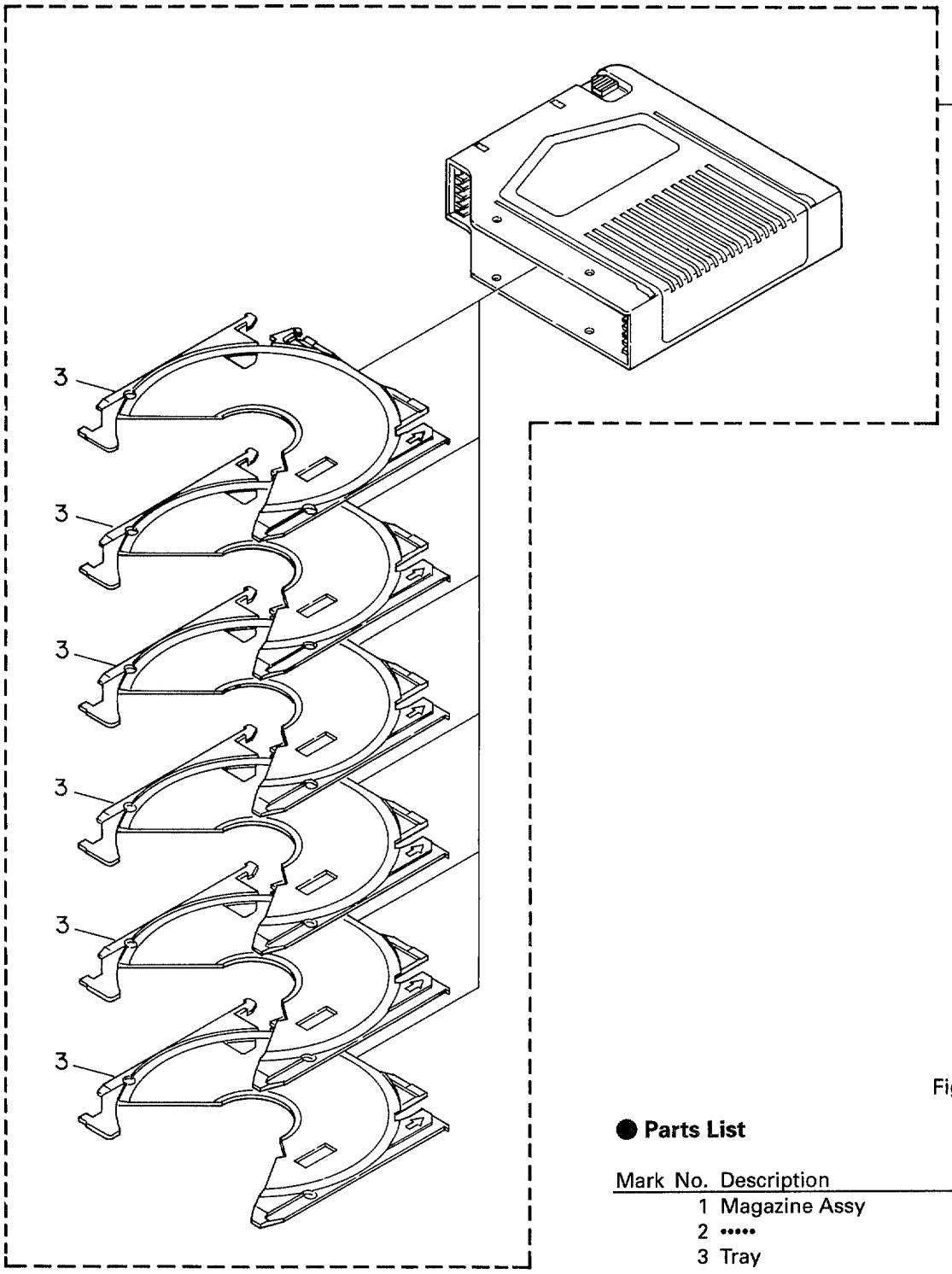


Fig.4

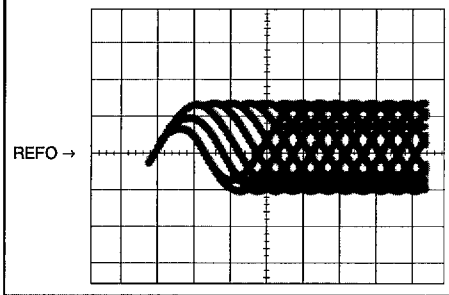
● **Parts List**

Mark No.	Description	Part No.
1	Magazine Assy	CXB1091
2	•••••	
3	Tray	CNV4381

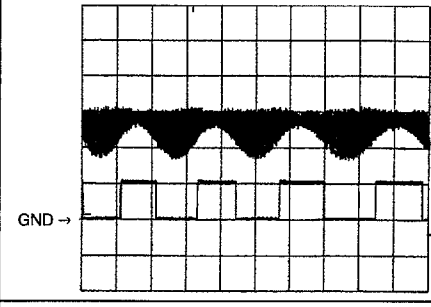
Note:1. The encircled numbers denote measuring pointes in the circuit diagram.
2. Reference voltage
REFO:2.5V

● Waveforms

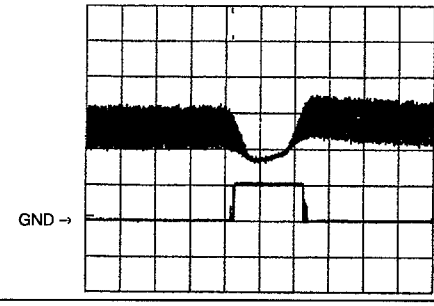
① RFO 0.5V/div. 0.5µs/div.
Normal mode: play



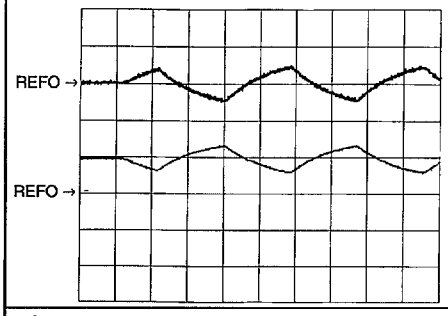
① CH1: RFO 1V/div.
② CH2: MIRR 5V/div. 0.5ms/div.
Test mode: Tracking open



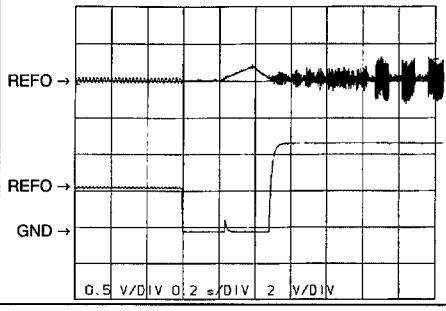
① CH1: RFO 1V/div.
② CH2: MIRR 5V/div. 0.5ms/div.
Normal mode: The defect part passes 800µm



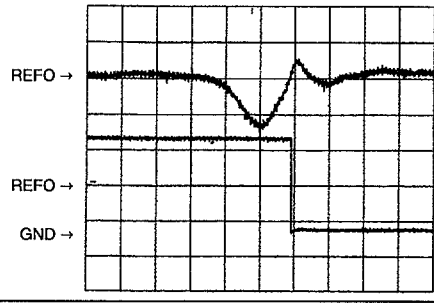
③ CH1: FD 0.5V/div.
④ CH2: FOP 2V/div. 0.2s/div.
Test mode: No disc, Focus close



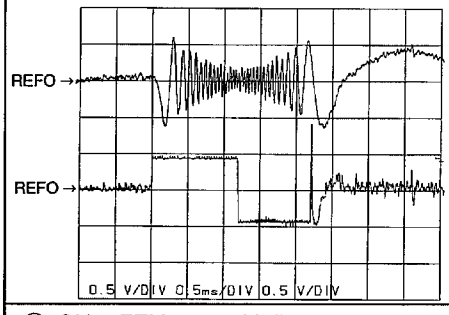
③ CH1: FD 0.5V/div.
⑤ CH2: FOK 2V/div. 0.2s/div.
Normal mode: Focus close



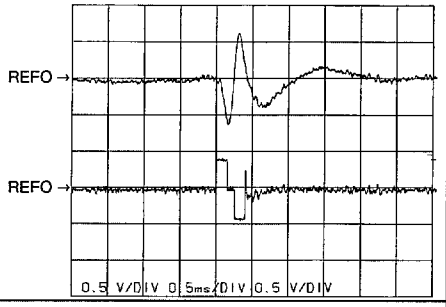
⑥ CH1: FEY 0.5V/div.
⑦ CH2: XSI 2V/div. 1ms/div.
Normal mode: Focus close



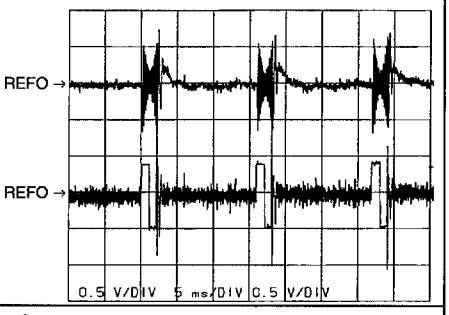
⑧ CH1: TEY 0.5V/div.
⑨ CH2: TD 0.5V/div. 0.5ms/div.
Test mode: 32 tracks jump (FWD)



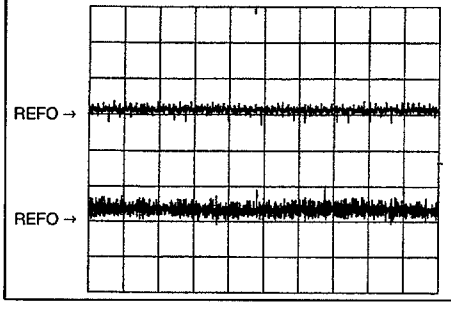
⑧ CH1: TEY 0.5V/div.
⑨ CH2: TD 0.5V/div. 0.5ms/div.
Test mode: Single jump (FWD)



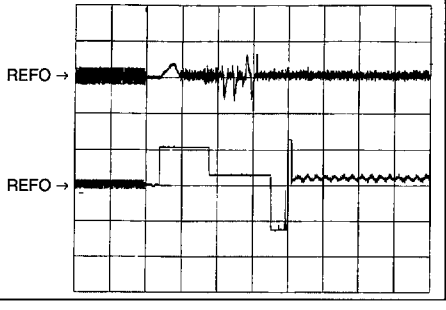
⑧ CH1: TEY 0.5V/div.
⑨ CH2: TD 0.5V/div. 5ms/div.
Test mode: 100 tracks jump (FWD)



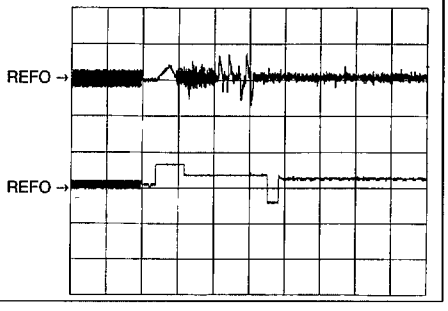
⑥ CH1: FEY 0.1V/div.
③ CH2: FD 0.2V/div. 20ms/div.
Normal mode: Play



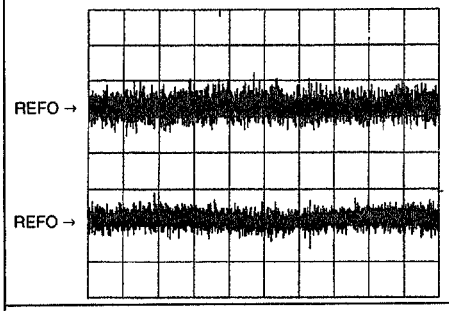
③ CH1: FD 0.5V/div.
⑩ CH2: MDYA 1V/div. 0.5s/div.
Normal mode: Focus close (12cm)



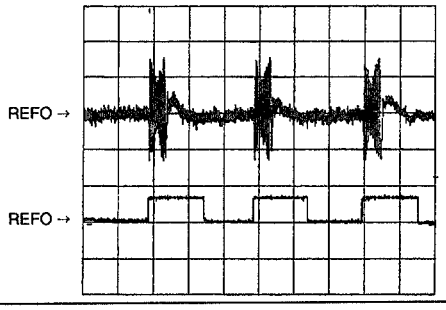
③ CH1: FD 0.5V/div.
⑩ CH2: MDYA 1V/div. 0.5s/div.
Normal mode: Focus close (8cm)



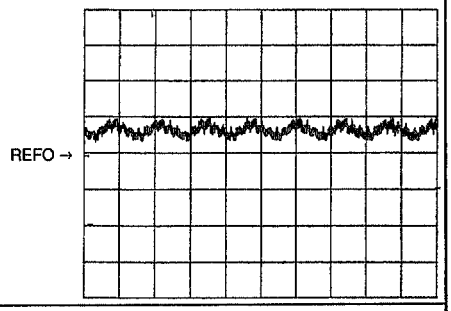
⑧ CH1: TEY 0.2V/div.
⑨ CH2: TD 0.2V/div. 20ms/div.
Normal mode: play



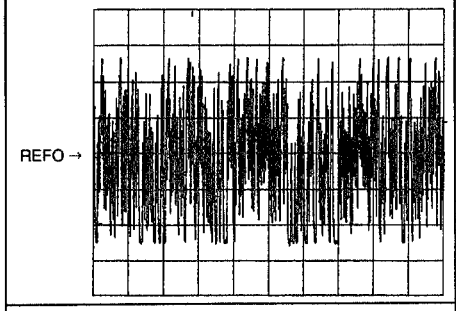
⑧ CH1: TEY 0.5V/div.
⑪ CH2: SD 0.5V/div. 5ms/div.



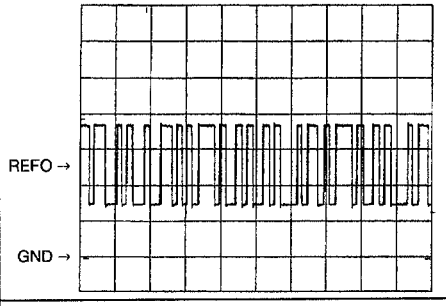
⑩ MDYA 0.5V/div. 0.1s/div.
Normal mode: Play (12cm)



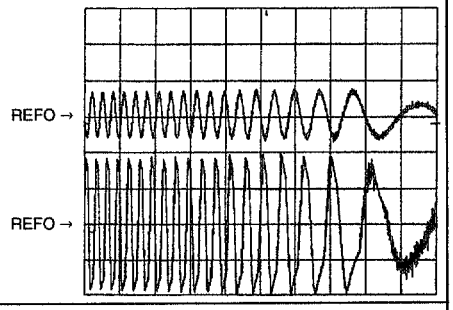
⑩ MDYA 0.5V/div. 10ms/div.
Long Search (12cm)



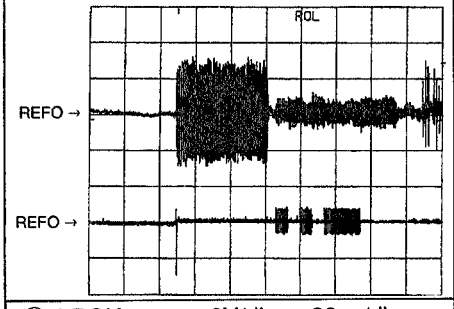
⑫ EFM 1V/div. 5µs/div.
Play



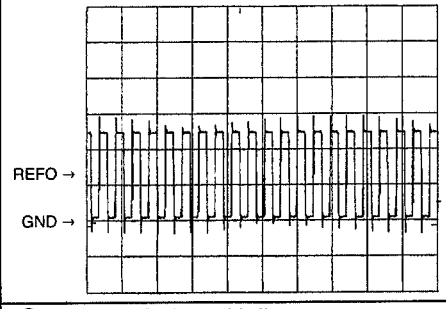
⑧ CH1: TEY 1V/div.
⑬ CH2: TEC 1V/div. 2ms/div.
Test mode: Focus close
Tracking open



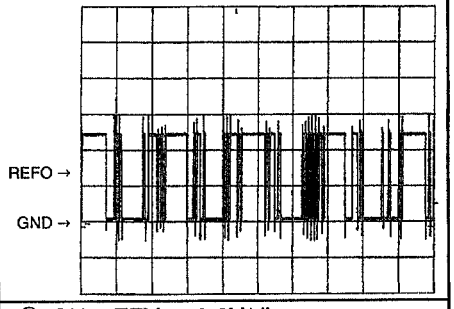
⑧ CH1: TEY 0.5V/div.
⑥ CH2: FEY 0.5V/div. 0.2s/div.
Normal mode: AGC after focus close



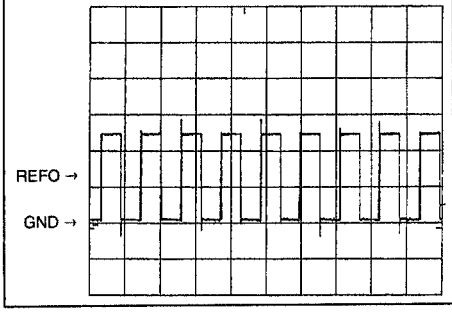
⑭ SCKO 2V/div. 1µs/div.
Play



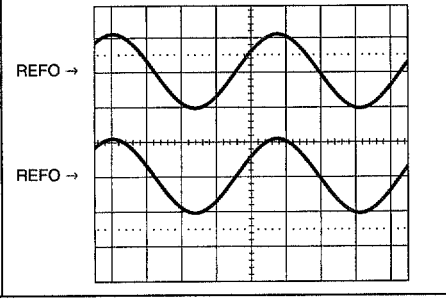
⑮ Dout 2V/div. 10µs/div.
Play



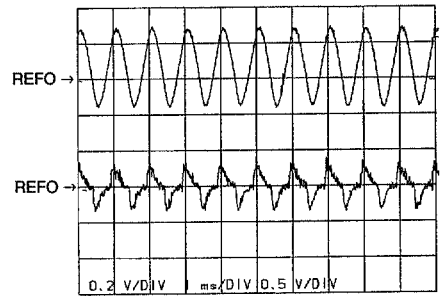
⑯ LRCK 2V/div. 20µs/div.

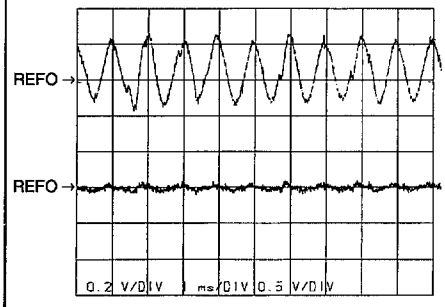
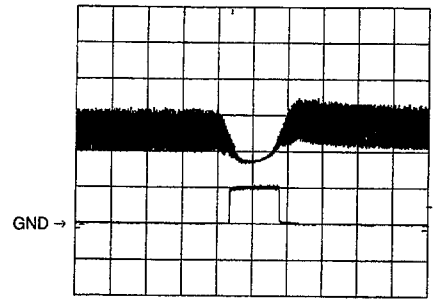
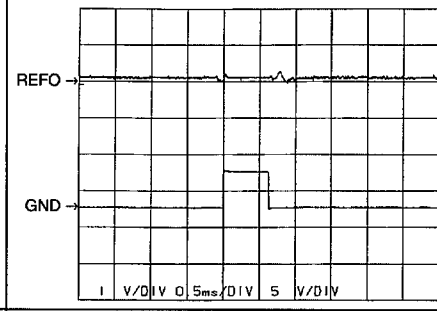


⑱ CH1: R OUT 1V/div.
⑰ CH2: L OUT 1V/div. 0.2ms/div.
Normal mode: Play (1kHz 0dB)



⑥ CH1: FEY 0.2V/div.
③ CH2: FD 0.5V/div. 1ms/div.
Normal mode: During AGC

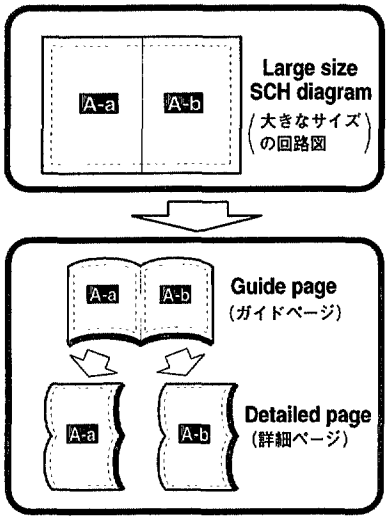


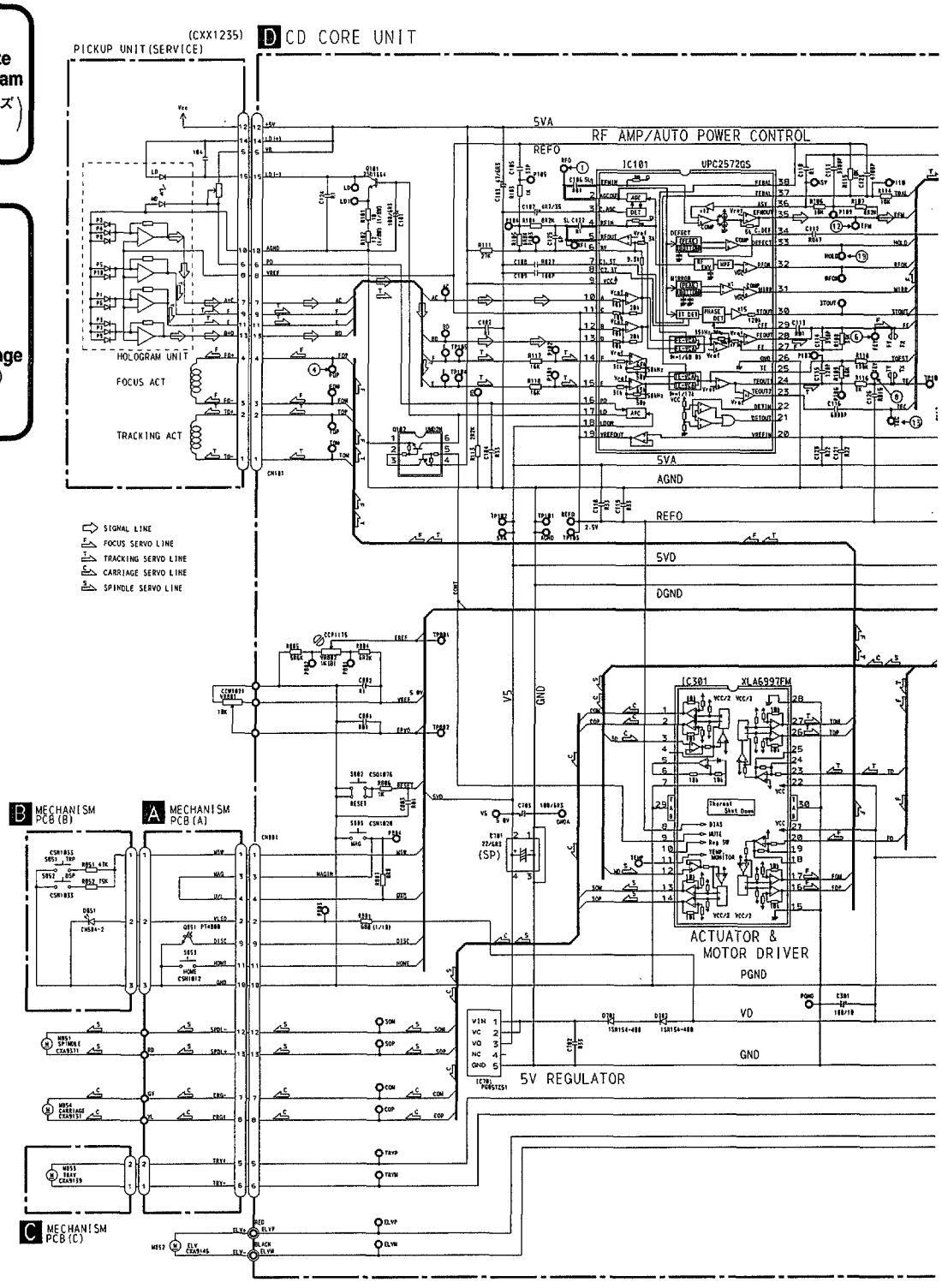
⑧ CH1: TEY 0.2V/div. ⑨ CH2: TD 0.5V/div. 1ms/div. Normal mode: During AGC  	① CH1: RFO 1V/div. ⑲ CH2: HOLD 5V/div. 0.5ms/div. Normal mode: The defect part passes 800µm  	③ CH1: FD 1V/div. ⑲ CH2: HOLD 5V/div. 0.5ms/div. Normal mode: The defect part passes 800µm 

3. SCHEMATIC DIAGRAM

3.1 CD MECHANISM MODULE

D-a





D-b

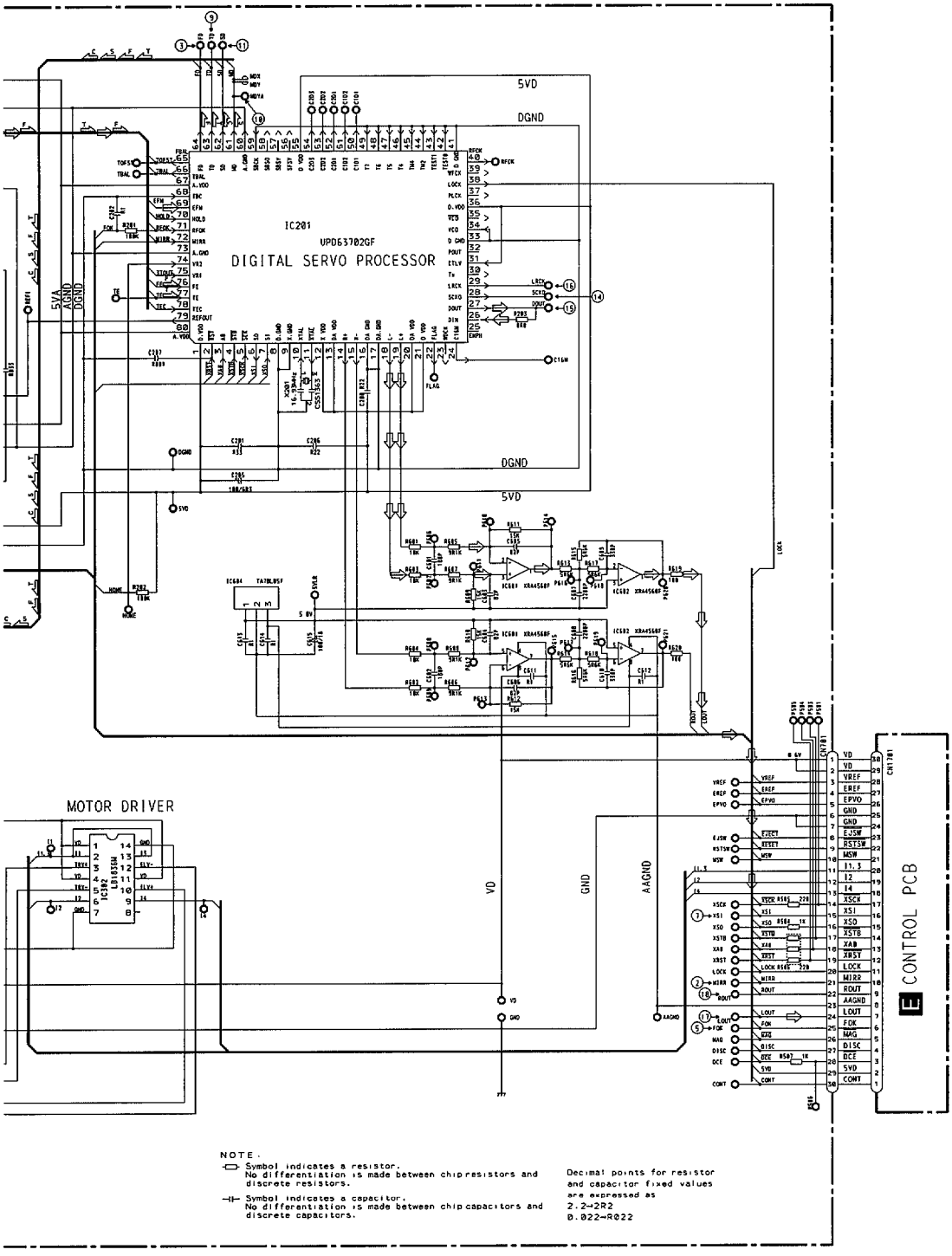
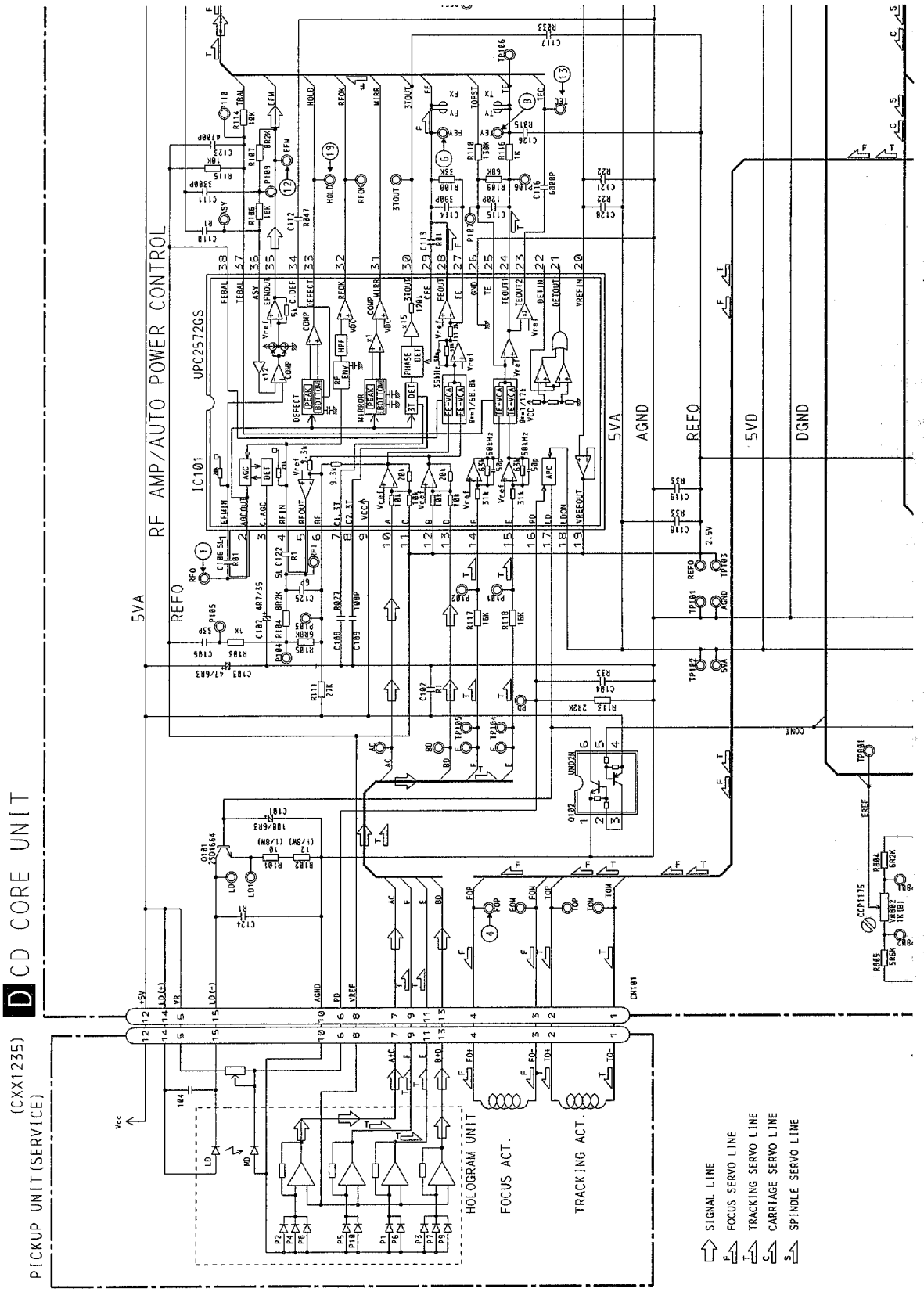

IC201
UPD63702GF
DIGITAL SERVO PROCESSOR
5VD
DGND
5VA
AGND
DGND
MOTOR DRIVER
VD
GND
AAGND
CONTROL PCB
NOTE.
Symbol indicates a resistor.
No differentiation is made between chip resistors and discrete resistors.
Symbol indicates a capacitor.
No differentiation is made between chip capacitors and discrete capacitors.
Decimal points for resistor and capacitor fixed values are expressed as
2.2→2R2
0.022→R022

Fig.5

D-a D-b


D CD CORE UNIT
RF AMP/AUTO POWER CONTROL
IC101
UPC2572GS
5VA
AGND
REFO
5VD
DGND
PICKUP UNIT (SERVICE)
(CXX1235)
HOLOGRAM UNIT
FOCUS ACT.
TRACKING ACT.
SIGNAL LINE
FOCUS SERVO LINE
TRACKING SERVO LINE
CARRIAGE SERVO LINE
SPINDLE SERVO LINE

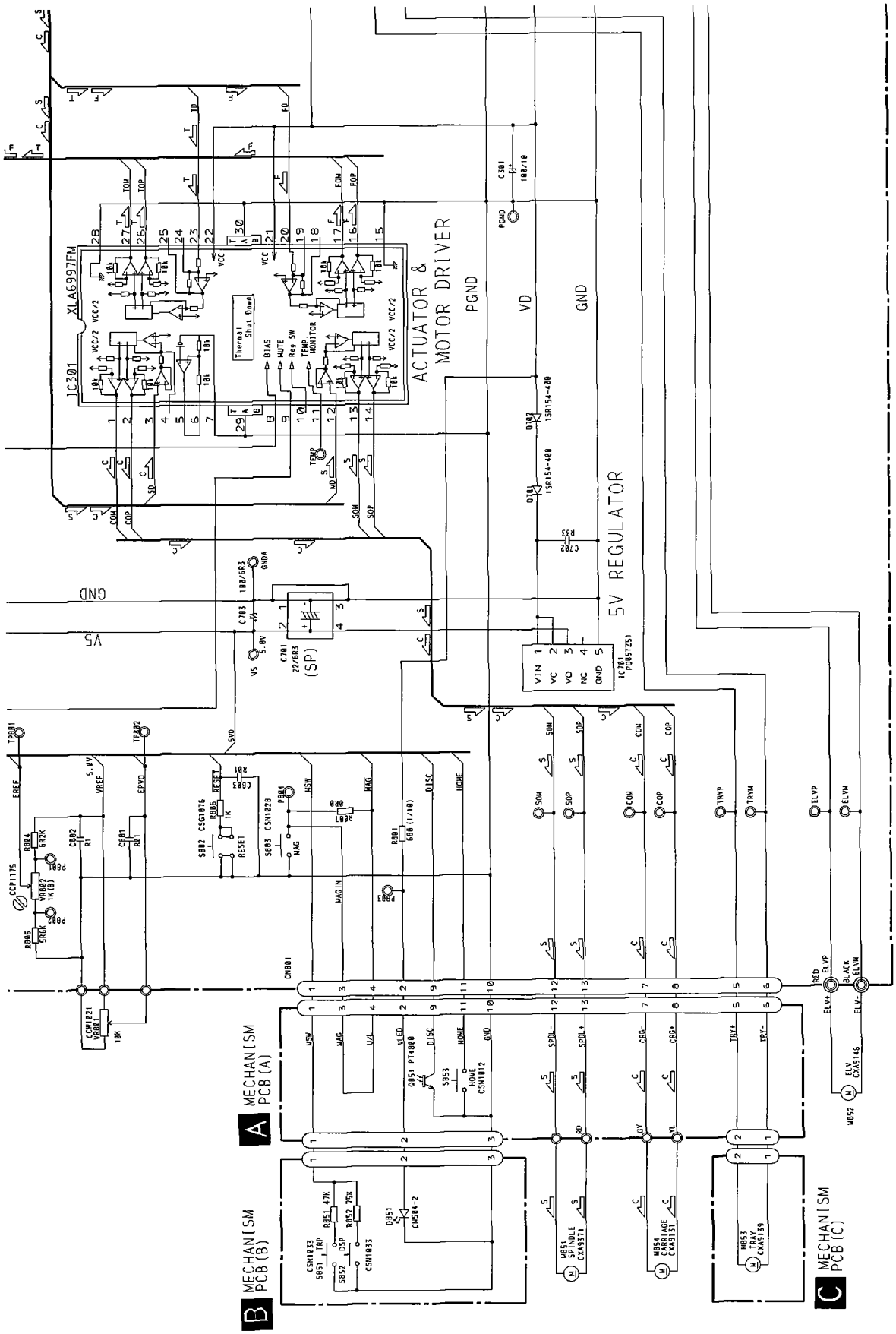
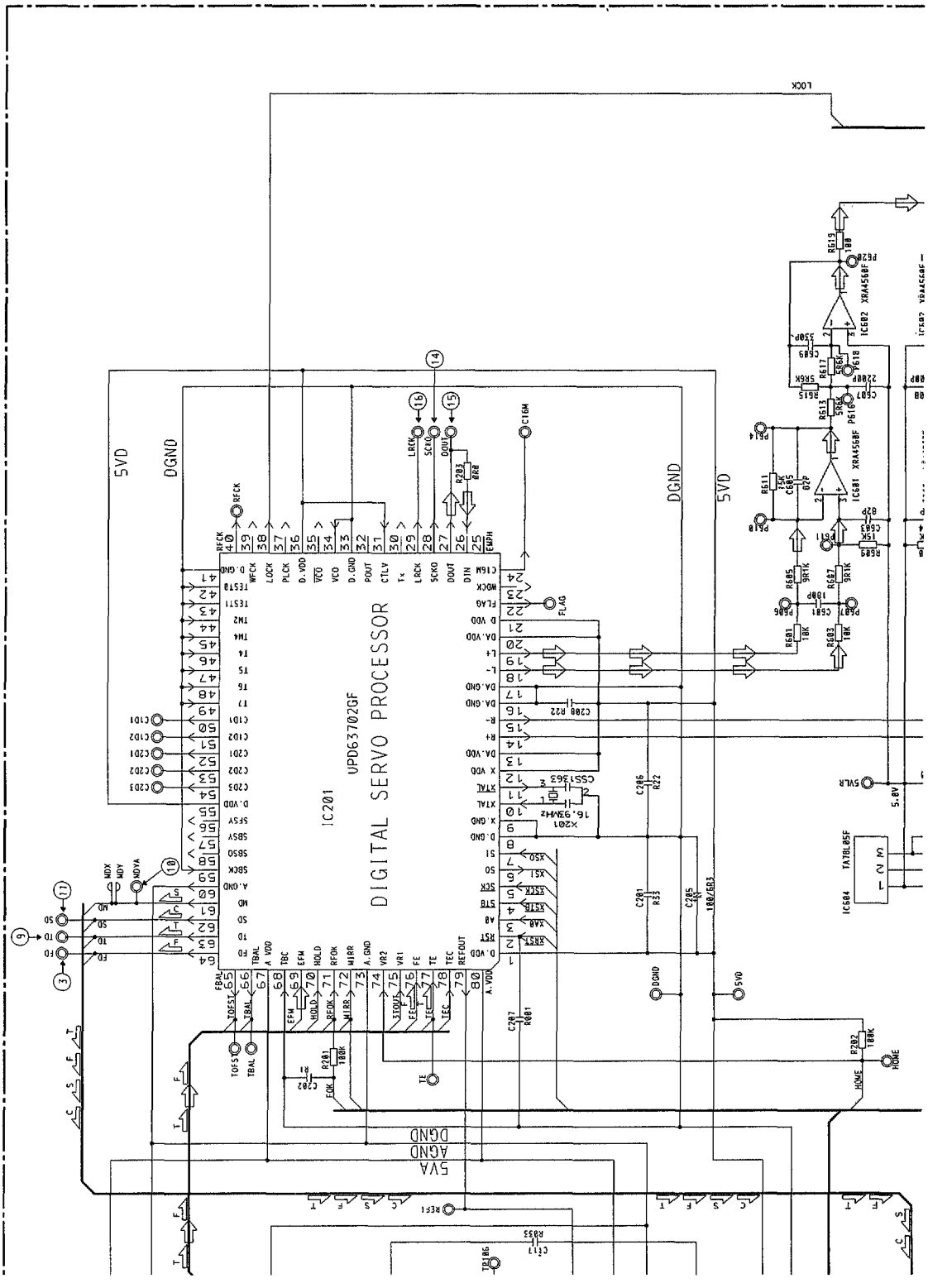

IC301
XLA6997FM
ACTUATOR &
MOTOR DRIVER
PGND
VD
GND
5V REGULATOR
IC701
PQ05TZ51
VIN
VC
VO
NC
GND
(SP)
A MECHANISM PCB (A)
B MECHANISM PCB (B)
C MECHANISM PCB (C)
CN801
CN1821
CN1833
CN1012
CN584-2
M051 SPINDLE CXA9371
M052 CXA9146
M053 TRAY CXA9139
M054 CARRIAGE CXA9137
D-a
D-b

Fig.6

D-a D-b


DIGITAL SERVO PROCESSOR
UPD637020F
IC201
5VD
DGND
AGND
5VA
LOCK
FLAG
HOME
TE
FE
TBAL
TOFST
EFM
HOLD
RFOK
MIRR
REFOUT
16.934M
X201
IC682
IC681
IC683
IC684
TA78L05F
5.8V

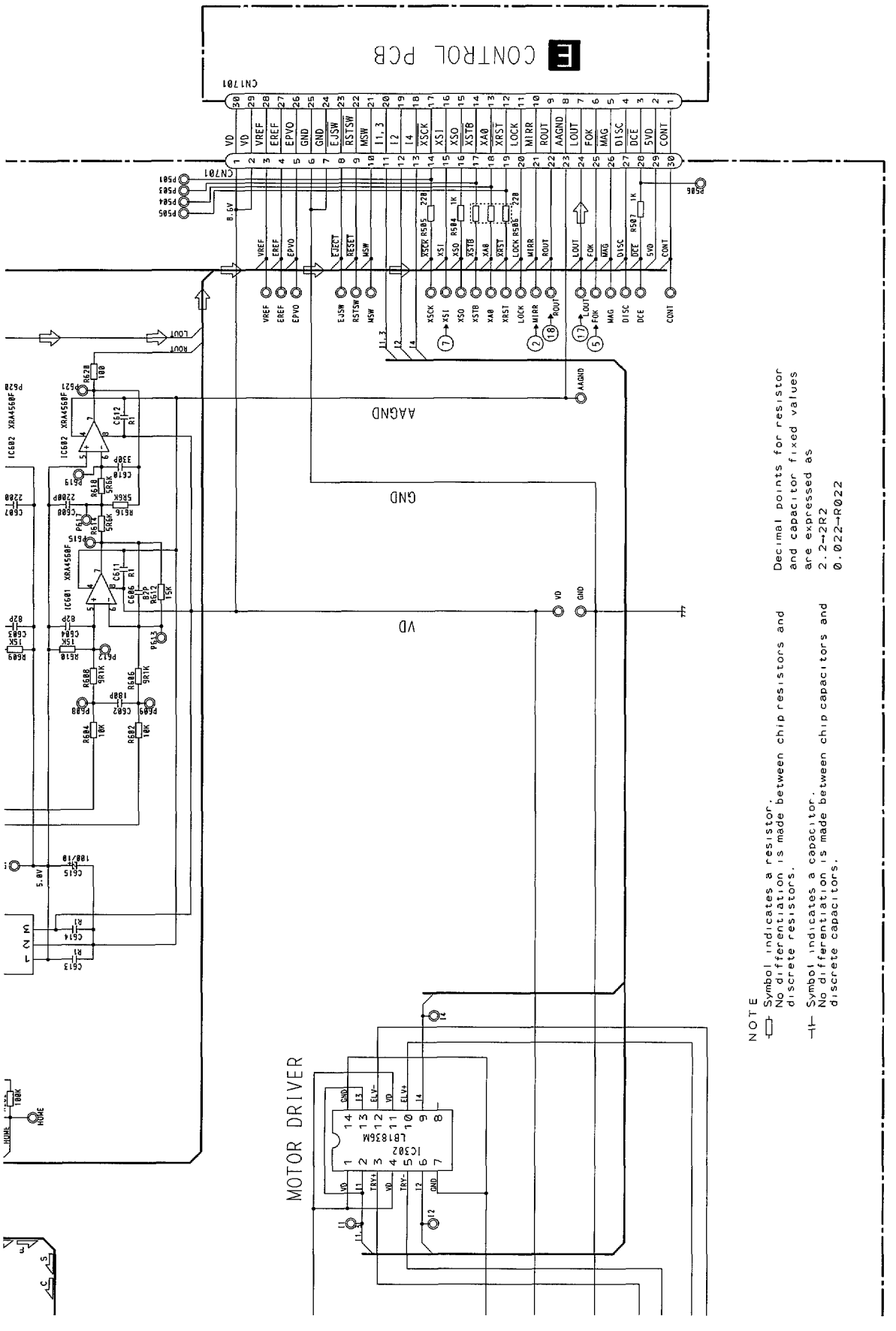
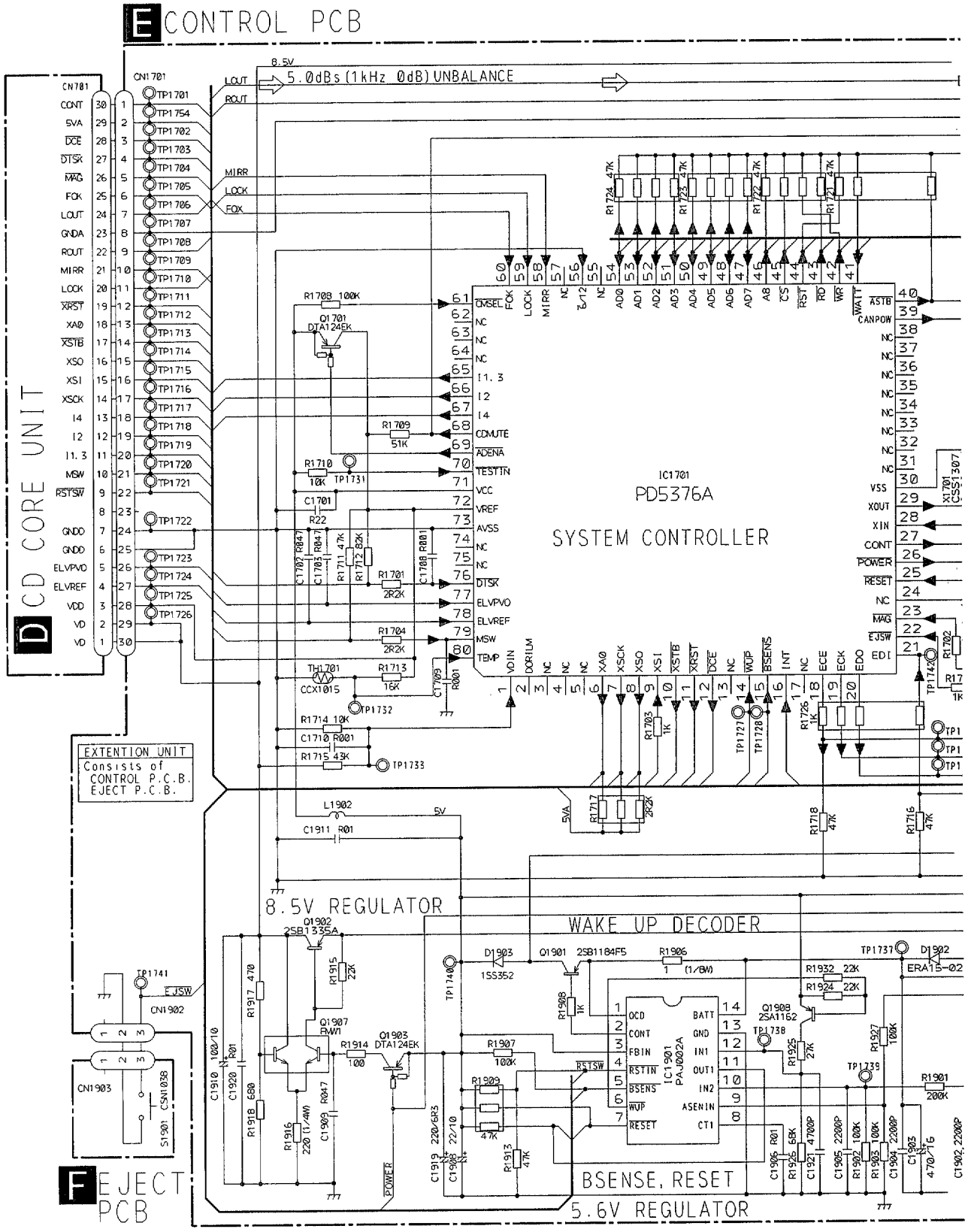
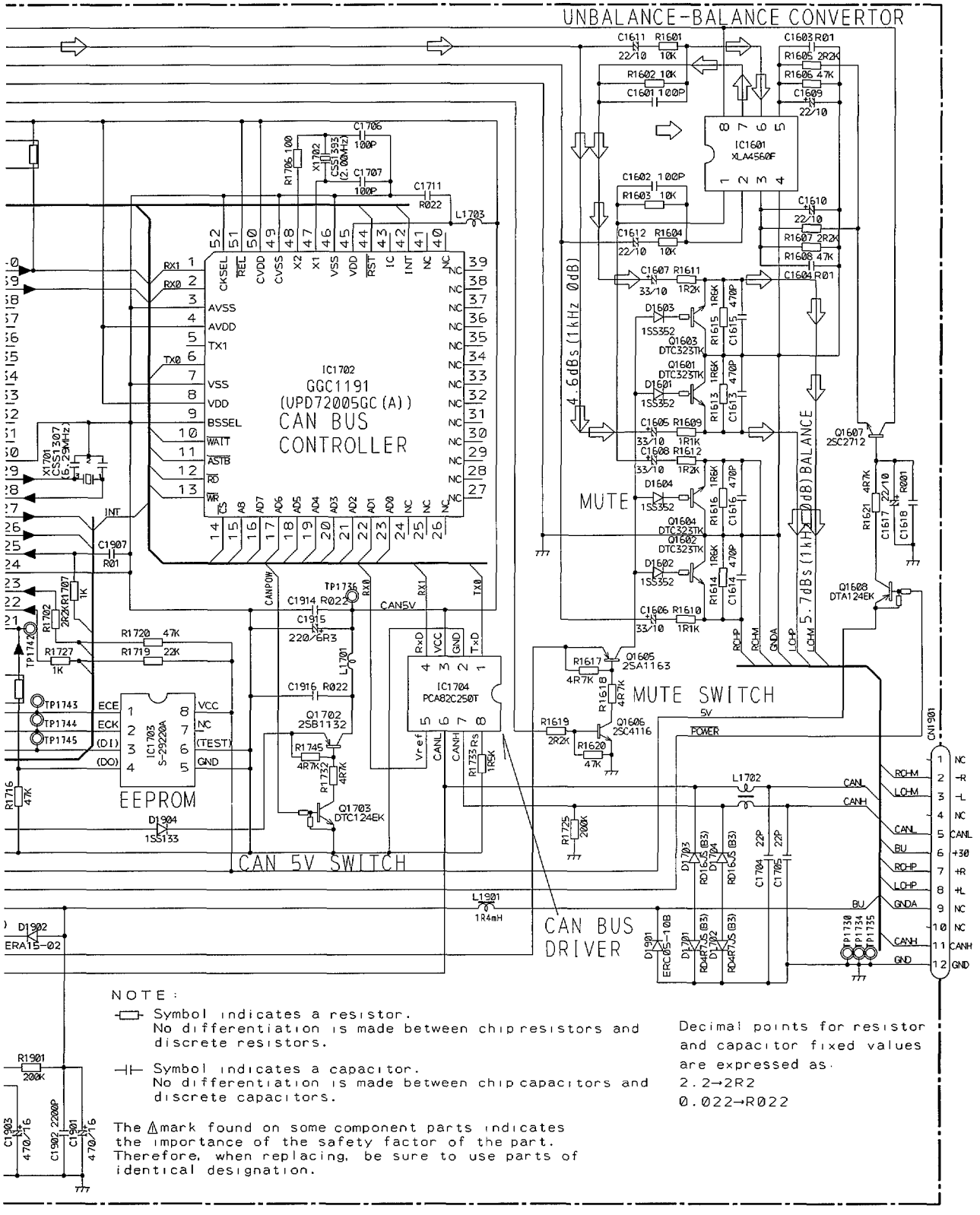

E CONTROL PCB
CN701
VD
VREF
EREF
EPVO
GND
EJSW
RSTSW
MSW
I1, 3
I2
I4
XSCK
XS1
XSO
XSTB
XA0
XRST
LOCK
MIRR
ROUT
AAGND
LOUT
FOK
MAG
DISC
DCE
5VD
CONT
AAGND
GND
VD
MOTOR DRIVER
LB1836M
IC302
NOTE
Symbol indicates a resistor.
No differentiation is made between chip resistors and discrete resistors.
Symbol indicates a capacitor.
No differentiation is made between chip capacitors and discrete capacitors.
Decimal points for resistor and capacitor fixed values are expressed as
2.2→2R2
0.022→R022

Fig.7

3.2 EXTENSION UNIT





NOTE :

- Symbol indicates a resistor. No differentiation is made between chip resistors and discrete resistors.
- Symbol indicates a capacitor. No differentiation is made between chip capacitors and discrete capacitors.

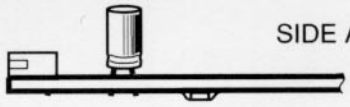
The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

Decimal points for resistor and capacitor fixed values are expressed as.
2.2→2R2
0.022→R022

Fig.8

4. PCB CONNECTION DIAGRAM

4.1 EXTENSION UNIT



E CONTROL PCB

IC, Q

IC1704
Q1603
Q1602 Q1604 Q1601

IC1702

Q1901 IC1601
Q1702
Q1605

Q1703

IC1901 Q1607
IC1701 Q1907
Q1606 Q1902
Q1908 Q1608 Q1903

Q1701
IC1703

D CN701

F CN1903

F EJECT PCB

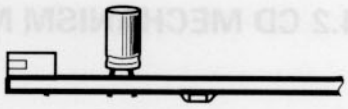
E CN1902

CN1903

NOTE:

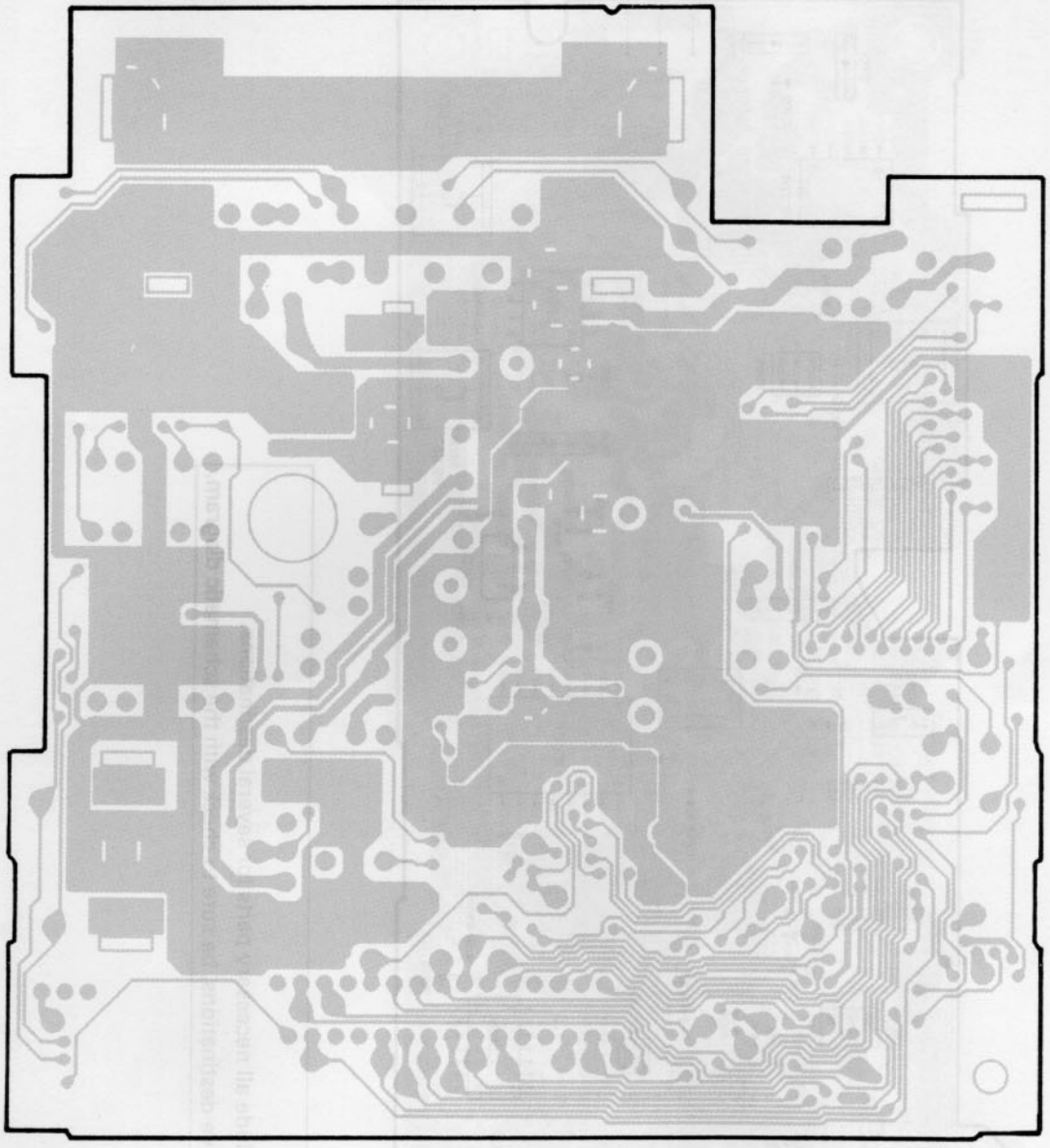
The parts mounted on this PCB include all necessary parts for several destinations.
For further information for respective destinations, be sure to check with the schematic diagram.

Fig.9



SIDE B

E CONTROL PCB



F EJECT PCB

NOTE:

The parts mounted on this PCB include all necessary parts for several destinations.
For further information for respective destinations, be sure to check with the schematic diagram.

Fig.10

4.2 CD MECHANISM MODULE

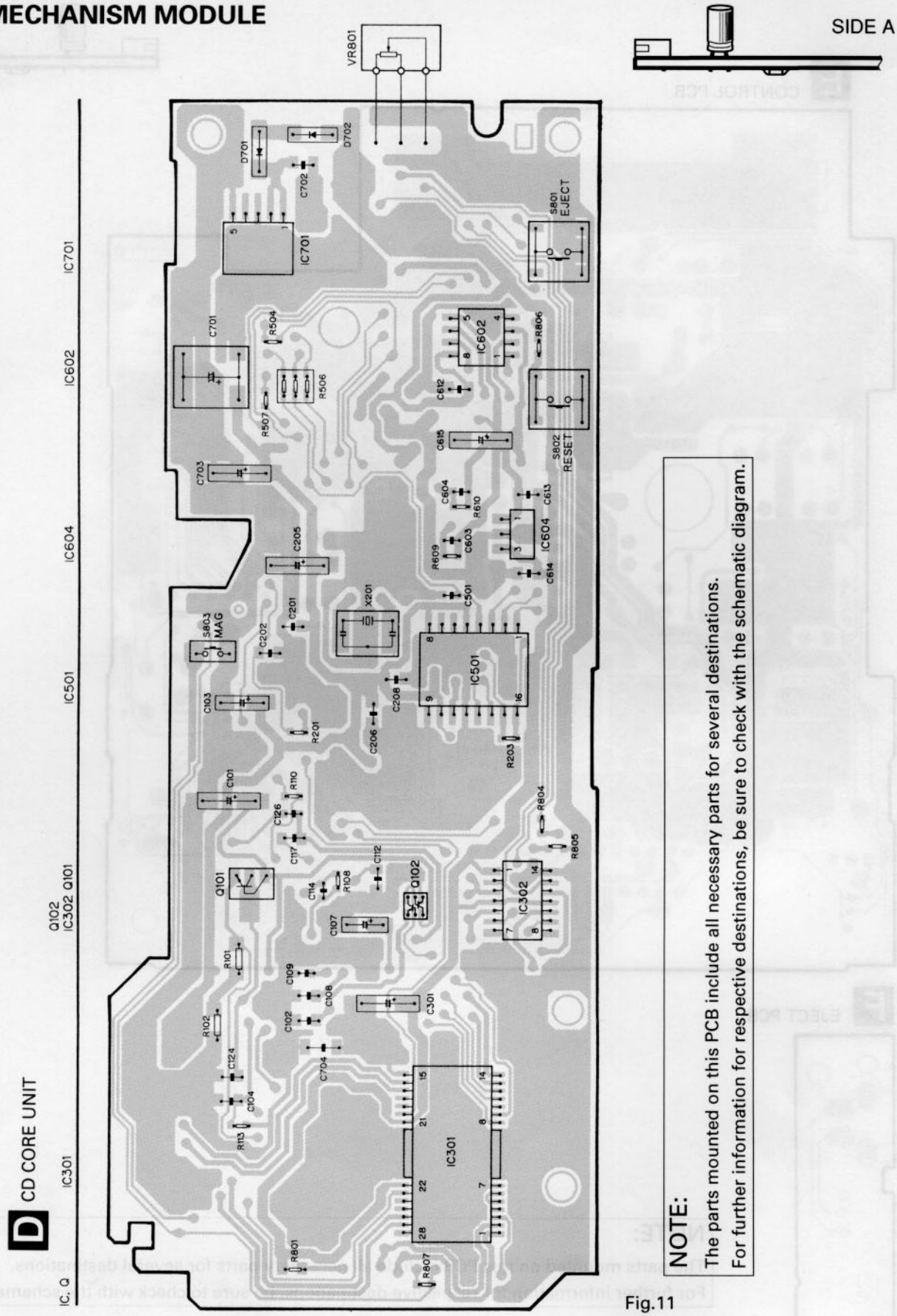
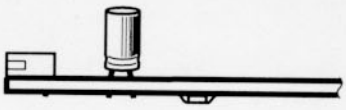


Fig.11

NOTE:
The parts mounted on this PCB include all necessary parts for several destinations.
For further information for respective destinations, be sure to check with the schematic diagram.



SIDE B

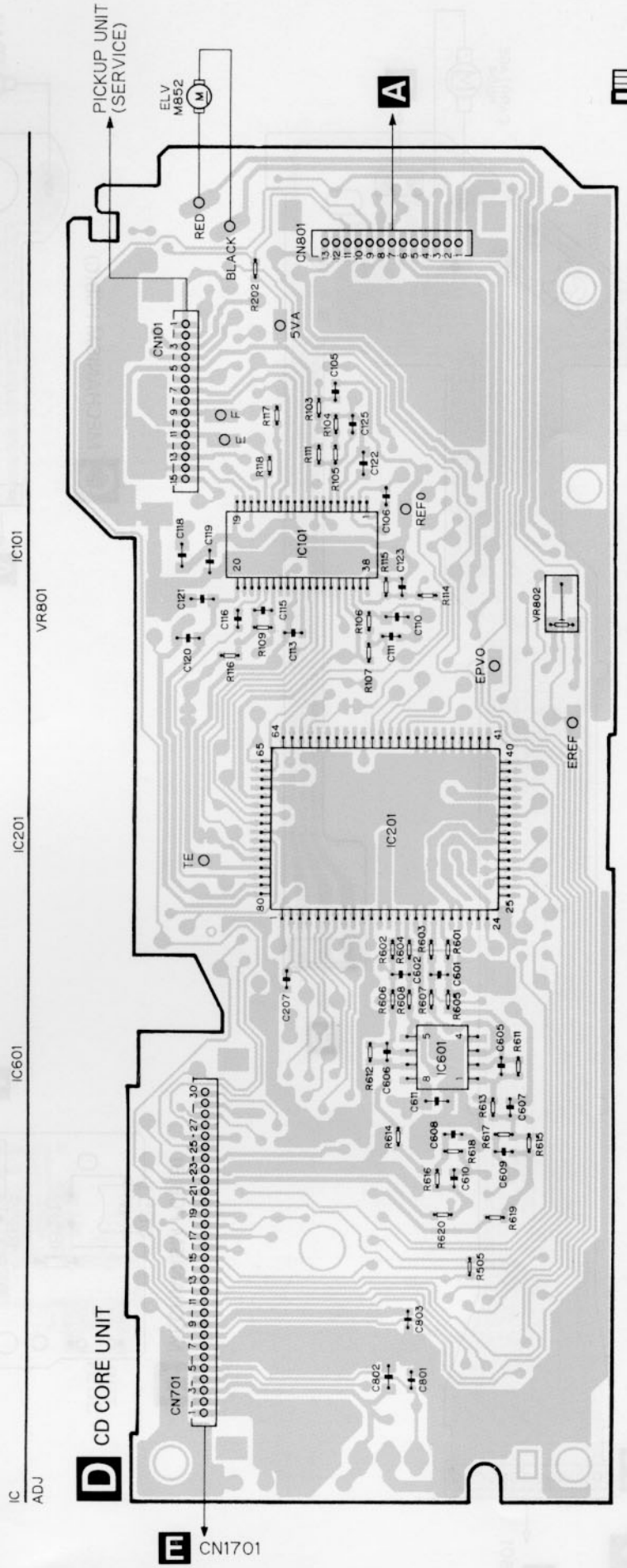


Fig.12

NOTE:

The parts mounted on this PCB include all necessary parts for several destinations.
For further information for respective destinations, be sure to check with the schematic diagram.

A MECHANISM PCB(A)
B MECHANISM PCB(B)
C MECHANISM PCB(C)
D CN801
HOME S853
SPINDLE M851
CARRIAGE M854
TRAY M853
Q851
R851
R852
DSP S852
TRP S851
RD
YL
GY
BL
BL

Fig.13

5. ELECTRICAL PARTS LIST

NOTE:

- Parts whose parts numbers are omitted are subject to being not supplied.
- The part numbers shown below indicate chip components.

Chip Resistor

RS1/○S○○○J,RS1/○○S○○○J

Chip Capacitor (except for CQS.....)

CKS....., CCS....., CSZS.....

=====Circuit Symbol & No.	Part Name=====	Part No.
D Unit Number : CWX2000		
Unit Name : CD Core Unit		
MISCELLANEOUS		
IC 101		UPC2572GS
IC 201		UPD63702GF
IC 301		XLA6997FM
IC 302		LB1836M
IC 601		XLA4560F
IC 602		XLA4560F
IC 604		TA78L05F
IC 701		PQ05TZ51
Q 101		2SD1664
Q 102		UMD2N
D 701		1SR154-400
D 702		1SR154-400
X 201	Ceramic Resonator 16.93MHz	CSS1363
S 802	Switch(RESET)	CSG1076
S 803	Switch(MAG)	CSN1028
VR 802	Semi-fixed 1kΩ(B)	CCP1175
RESISTORS		
R 101		RS1/8S100J
R 102		RS1/8S120J
R 103		RS1/16S102J
R 104		RS1/16S822J
R 105		RS1/16S682J
R 106		RS1/16S183J
R 107		RS1/16S822J
R 108		RS1/16S333J
R 109		RS1/16S683J
R 110		RS1/16S134J
R 111		RS1/16S273J
R 113		RS1/16S222J
R 114		RS1/16S103J
R 115		RS1/16S103J
R 116		RS1/16S102J
R 117		RS1/16S163J
R 118		RS1/16S163J
R 201		RS1/16S104J
R 202		RS1/16S104J
R 203		RS1/16S0R0J
R 504		RS1/16S102J
R 505		RS1/16S221J
R 506		RA3C221J
R 507		RS1/16S102J
R 601		RS1/16S103J
R 602		RS1/16S103J
R 603		RS1/16S103J
R 604		RS1/16S103J
R 605		RS1/16S912J
R 606		RS1/16S912J

=====Circuit Symbol & No.	Part Name=====	Part No.
R 607		RS1/16S912J
R 608		RS1/16S912J
R 609		RS1/16S153J
R 610		RS1/16S153J
R 611		RS1/16S153J
R 612		RS1/16S153J
R 613		RS1/16S562J
R 614		RS1/16S562J
R 615		RS1/16S562J
R 616		RS1/16S562J
R 617		RS1/16S562J
R 618		RS1/16S562J
R 619		RS1/16S101J
R 620		RS1/16S101J
R 801		RS1/10S681J
R 804		RS1/16S622J
R 805		RS1/16S562J
R 806		RS1/16S102J
R 807		RS1/16S0R0J
CAPACITORS		
C 101		CEV101M6R3
C 102		CKSQYB104K16
C 103		CEV470M6R3
C 104		CKSQYB334K16
C 105		CCSRCH330J50
C 106		CKSRYB103K25
C 107		CEV4R7M35
C 108		CKSQYB273K25
C 109		CCSRCH101J50
C 110		CKSQYB104K16
C 111		CKSRYB332K50
C 112		CKSQYB473K25
C 113		CKSRYB103K25
C 114		CKSRYB391K50
C 115		CCSRCH121J50
C 116		CKSRYB682K50
C 117		CKSQYB333K25
C 118		CKSQYB334K16
C 119		CKSQYB334K16
C 120		CKSQYB224K16
C 121		CKSQYB224K16
C 122		CKSQYB104K16
C 123		CKSRYB472K50
C 124		CKSQYB104K16
C 125		CCSRCH060D50
C 126		CKSRYB153K25
C 201		CKSQYB334K16
C 202		CKSQYB104K16
C 205		CEV101M6R3
C 206		CKSQYB224K16

=====Circuit Symbol & No.	Part Name=====	Part No.
C 207		CKSRYB102K50
C 208		CKSQYB224K16
C 301		CEV101M10
C 601		CCSRCH181J50
C 602		CCSRCH181J50
C 603		CCSRCH820J50
C 604		CCSRCH820J50
C 605		CCSRCH820J50
C 606		CCSRCH820J50
C 607		CKSRYB222K50
C 608		CKSRYB222K50
C 609		CCSRCH331J50
C 610		CCSRCH331J50
C 611		CKSQYB104K16
C 612		CKSQYB104K16
C 613		CKSQYB104K16
C 614		CKSQYB104K16
C 615		CEV101M10
C 701	22µF/6.3V	CCH1233
C 702		CKSQYB334K16
C 703		CEV101M6R3
C 801		CKSRYB103K25
C 802		CKSQYB104K16
C 803		CKSRYB103K25

Extension Unit
Consists of
Control PCB
Eject PCB

E F Unit Number : CWX1983
Unit Name : Extension Unit

MISCELLANEOUS

IC 1601		XLA4560F
IC 1701		PD5376A
IC 1702	(UPD72005GC(A))	GGC1191
IC 1703		S-29220A
IC 1704		PCA82C250T
IC 1901		PAJ002A
Q 1601		DTC323TK
Q 1602		DTC323TK
Q 1603		DTC323TK
Q 1604		DTC323TK
Q 1605		2SA1163
Q 1606		2SC4116
Q 1607		2SC2712
Q 1608		DTA124EK
Q 1701		DTA124EK
Q 1702		2SB1132
Q 1703		DTC124EK
Q 1901		2SB1184F5
Q 1902		2SB1335A
Q 1903		DTA124EK
Q 1907		FMW1
Q 1908		2SA1162
D 1601		1SS352
D 1602		1SS352
D 1603		1SS352
D 1604		1SS352
D 1701		RD4R7JS(B3)
D 1702		RD4R7JS(B3)
D 1703		RD16JS(B3)
D 1704		RD16JS(B3)
D 1901		ERC05-10B
D 1902		ERA15-02
D 1903		1SS352
D 1904		1SS133
L 1701	Ferri-Inductor	LAU4R7K

=====Circuit Symbol & No.	Part Name=====	Part No.
L 1702	Choke Coil	CTH1180
L 1703	Ferri-Inductor	LAU220K
L 1901	Choke Coil 1.4mH	CTH1129
L 1902	Inductor	LAU100K
TH 1701	Thermistor	CCX1015
X 1701	Resonator 6.29MHz	CSS1307
X 1702	Resonator 2.00MHz	CSS1393
S 1901	Switch(EJECT)	CSN1038

RESISTORS

R 1601	RS1/10S103J
R 1602	RS1/10S103J
R 1603	RS1/10S103J
R 1604	RS1/10S103J
R 1605	RS1/10S222J
R 1606	RS1/10S473J
R 1607	RS1/10S222J
R 1608	RS1/10S473J
R 1609	RS1/10S112J
R 1610	RS1/10S112J
R 1611	RS1/10S122J
R 1612	RS1/10S122J
R 1613	RS1/10S162J
R 1614	RS1/10S162J
R 1615	RS1/10S162J
R 1616	RS1/10S162J
R 1617	RS1/10S472J
R 1618	RS1/10S472J
R 1619	RS1/10S223J
R 1620	RS1/10S473J
R 1621	RS1/10S472J
R 1701	RS1/10S222J
R 1702	RS1/10S222J
R 1703	RS1/10S102J
R 1704	RS1/10S222J
R 1706	RS1/10S101J
R 1707	RS1/10S102J
R 1708	RS1/10S104J
R 1709	RS1/10S513J
R 1710	RS1/10S103J
R 1711	RS1/10S473J
R 1712	RS1/10S823J
R 1713	RS1/10S163J
R 1714	RS1/10S103J
R 1715	RS1/10S433J
R 1716	RS1/10S473J
R 1717	RA3C222J
R 1718	RS1/10S473J
R 1719	RS1/16S223J
R 1720	RS1/10S473J
R 1721	RA3C473J
R 1722	RA4C473J
R 1723	RA4C473J
R 1724	RA4C473J
R 1725	RS1/10S204J
R 1726	RA4C102J
R 1727	RS1/16S102J
R 1732	RS1/10S472J
R 1733	RS1/10S152J
R 1745	RS1/10S472J
R 1901	RS1/10S204J
R 1902	RS1/10S104J
R 1903	RS1/10S104J
R 1906	RS1/8S1R0J
R 1907	RS1/10S104J

=====Circuit Symbol & No.	Part Name=====	Part No.
R 1908		RS1/10S102J
R 1909		RA3C473J
R 1913		RS1/10S473J
R 1914		RS1/10S101J
R 1915		RS1/10S223J
R 1916		RD1/4PU221J
R 1917		RS1/10S471J
R 1918		RS1/10S681J
R 1924		RS1/10S223J
R 1925		RS1/10S273J
R 1926		RS1/10S683J
R 1927		RS1/10S104J
R 1932		RS1/10S223J
CAPACITORS		
C 1601		CCSQCH101J50
C 1602		CCSQCH101J50
C 1603		CKSQYB103K25
C 1604		CKSQYB103K25
C 1605		CEA330M10LL
C 1606		CEA330M10LL
C 1607		CEA330M10LL
C 1608		CEA330M10LL
C 1609		CEA220M10LL
C 1610		CEA220M10LL
C 1611		CEA220M10NPLL
C 1612		CEA220M10NPLL
C 1613		CKSQYB471K50
C 1614		CKSQYB471K50
C 1615		CKSQYB471K50
C 1616		CKSQYB471K50
C 1617		CEA220M10LL
C 1618		CKSQYB102K50
C 1701		CKSQYB224K16
C 1702		CKSQYB473K50
C 1703		CKSQYB473K50
C 1704		CCSQCH220J50
C 1705		CCSQCH220J50
C 1706		CCSQCH101J50
C 1707		CCSQCH101J50
C 1708		CKSQYB102K50
C 1709		CKSQYB102K50
C 1710		CKSQYB102K50
C 1711		CKSQYB223K50
C 1901	470µF/16V	CCH1080
C 1902		CKSQYB222K50
C 1903	470µF/16V	CCH1080
C 1904		CKSQYB222K50
C 1905		CKSQYB222K50
C 1906		CKSQYB103K25
C 1907		CKSQYB103K25
C 1908		CSZA220M10
C 1909		CKSQYB473K50
C 1910		CEA101M10LL
C 1911		CKSQYB103K25
C 1914		CKSQYB223K25
C 1915		CEA221M6R3LL
C 1916		CKSQYB223K25
C 1919		CEA221M6R3LL
C 1920		CKSQYB103K50
C 1921		CCSCH472J50

=====Circuit Symbol & No.	Part Name=====	Part No.
A Unit Number :		
Unit Name :	Mechanism PCB (A)	
Q 851	Photo Transistor	PT4800
S 853	Switch (HOME)	CSN1012
B Unit Number :		
Unit Name :	Mechanism PCB (B)	
D 851		CN504-2
S 851	Switch (TRP)	CSN1033
S 852	Switch (DSP)	CSN1033
R 851		RS1/8S473J
R 852		RS1/8S753J
C Unit Number :		
Unit Name :	Mechanism PCB (C)	
M 853	Motor Unit (TRAY)	CXA9139
Miscellaneous Parts List		
M 851	Motor Unit (SPINDLE)	CXA9371
M 852	Motor Unit (ELV)	CXA9146
M 854	Motor Unit (CARRIAGE)	CXA9131
VR 801	Volume 10kΩ	CCW1021
	Pickup Unit (Service)	CXX1235

6. ADJUSTMENT

6.1 CD ADJUSTMENT

1)Precautions

- This unit uses a single power supply (+5V) for the regulator. The signal reference potential, therefore, is connected to REFO(approx. 2.5V) instead of GND.
  If REFO and GND are connected to each other by mistake during adjustments,not only will it be impossible to measure the potential correctly,but the servo will malfunction and a severe shock will be applied to the pick-up. To avoid this,take special note of the following.
  Do not connect the negative probe of the measuring equipment to REFO and GND together. It is especially important not to connect the channel 1 negative probe of the oscilloscope to REFO with the channel 2 negative probe connected to GND.
  Since the frame of the measuring instrument is usually at the same potential as the negative probe,change the frame of the measuring instrument to floating status.
  If by accident REFO comes in contact with GND,immediately switch the regulator or power OFF.

- Always make sure the regulator is OFF when connecting and disconnecting the various filters and wiring required for measurements.

- Before proceeding to further adjustments and measurements after switching regulator ON,let the player run for about one minute to allow the circuits to stabilize.

- Since the protective systems in the unit's software are rendered inoperative in test mode,be very careful to avoid mechanical and /or electrical shocks to the system when making adjustment.

- This unit is adjusted in a combination with the CD control unit (FX-M2016ZSA, FX-M2116ZSA or FX-2316ZSA). Each regulator key should be operated at the unit.
  With the FX-M2016ZSA, FX-M2116ZSA or FX-2316ZSA taken up for reference, a description will be given below concerning how to enter into the test mode, including key operations. The key in the adjustment text is also one of the FX-M2016ZSA, FX-M2116ZSA or FX-2316ZSA keys.

- How to enter into the test mode
  Switch +30(BACK UP) ON while pressing the **VOL** and **CD** keys together.

- Resetting the test mode
  Switch +30(BACK UP) OFF.

- Disc detection during loading and eject operations is performed by means of a photo transistor in this unit.Consequently,if the inside of the unit is exposed to a strong light source when the outer casing is removed for repairs or adjustment,the following malfunctions may occur.
  *During PLAY, even if the eject button is pressed,the disc will not be ejected and the unit will remain in the PLAY mode.
  *The unit will not load a disc.
  When the unit malfunctions this way,either re-position the light source,move the unit or cover the photo transistor.

- When loading and unloading discs during adjustment procedures,always wait for the disc to be properly clamped or ejected before pressing another key. Otherwise, there is a risk of the actuator being destroyed.

- Turn power off when pressing the button **UP** or the button **DOWN** key for focus search in the test mode. (Or else lens may stick and the actuator may be damaged.)

- SINGLE/4TRK/10TRK/32TRK will continue to operate even after the key is released.Tracking is closed the moment C-MOVE is released.

- JUMP MODE resets to SINGLE as soon as power is switched OFF.

6.2 CHECKING THE GRATING

● Checking the Grating After Changing the PU Unit

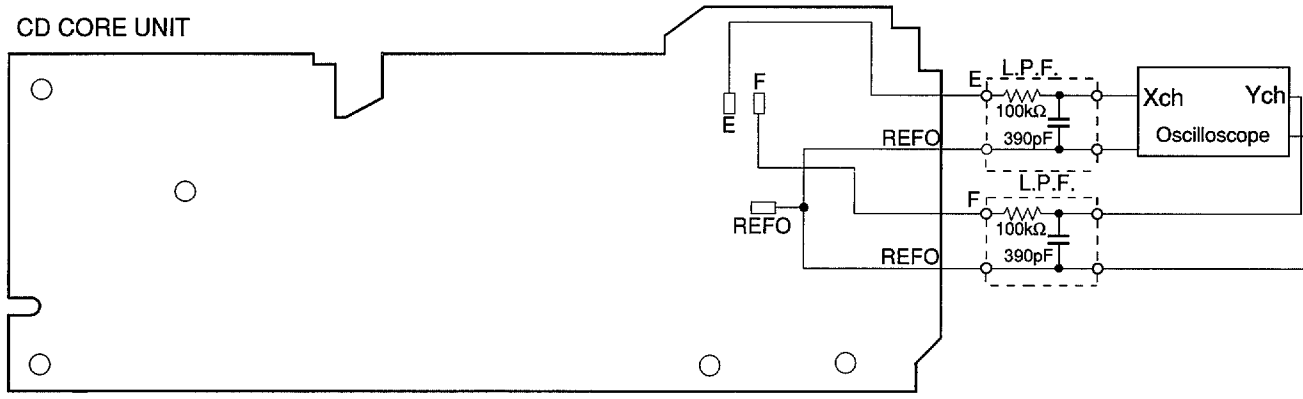
·**Note :**
Unlike previous CD mechanism modules the grating angle of the pickup unit cannot be adjusted after the pickup unit is changed. The pickup unit in the CD mechanism module is adjusted on the production line to match the CD mechanism module and is thus the best adjusted pickup unit for the CD mechanism module. Changing the pickup unit is thus best considered as a last resort. However, if the pickup unit must be changed, the grating should be checked using the procedure below.

·**Purpose :**
To check that the grating is within an acceptable range.

·**Symptoms of Mal-adjustment :**
If the grating is off by a large amount symptoms such as being unable to close tracking, being unable to perform track search operations, or track searching taking a long time, may appear.

·**Method :**

·Measuring Equipment	·Oscilloscope, Two L.P.F.
·Measuring Points	·E, F, REFOUT
·Disc	·ABEX TCD-784
·Mode	·TEST MODE



·**Checking Procedure**

1. In test mode, load the disc and switch the 5V regulator on.
2. Using the **UP** and **DOWN** buttons, move the PU unit to the innermost track.
3. Press key **5** to close focus, the display should read "91". Press key **2** to implement the tracking balance adjustment the display should now read "81". Press key **5** 4 times. The display will change, returning to "81" on the fourth press.
4. As shown in the diagram above, monitor the LPF outputs using the oscilloscope and check that the phase difference is within 75° . Refer to the photographs supplied to determine the phase angle.
5. If the phase difference is determined to be greater than 75° try changing the PU unit to see if there is any improvement. If, after trying this a number of times, the grating angle does not become less than 75° then the mechanism should be judged to be at fault.

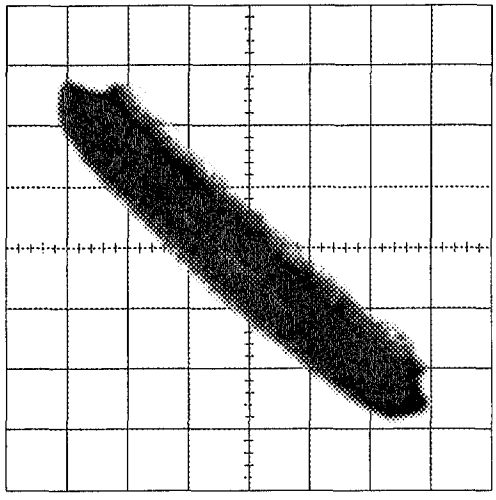
·**Note**
Because of eccentricity in the disc and a slight misalignment of the clamping center the grating waveform may be seen to "wobble" (the phase difference changes as the disc rotates). The angle specified above indicates the average angle.

·**Hint**
Reloading the disc changes the clamp position and may decrease the "wobble".

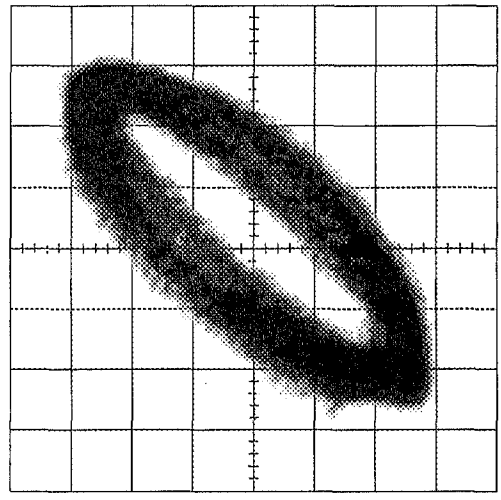
Grating waveform

Ech → Xch 20mV/div, AC
Fch → Ych 20mV/div, AC

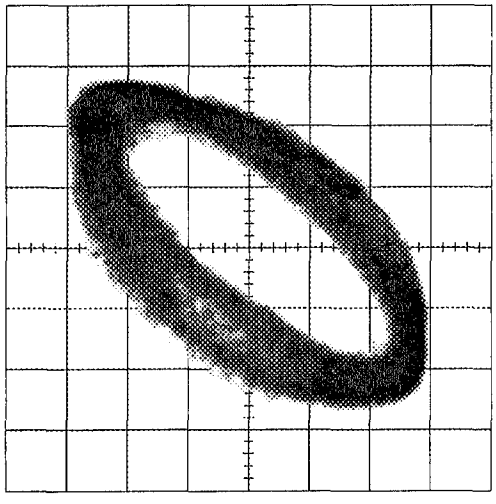
0°



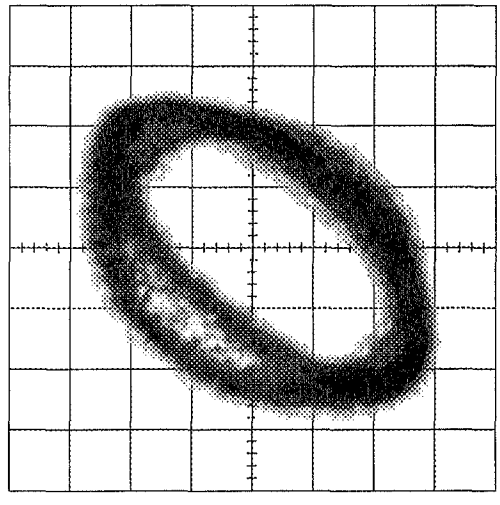
30°



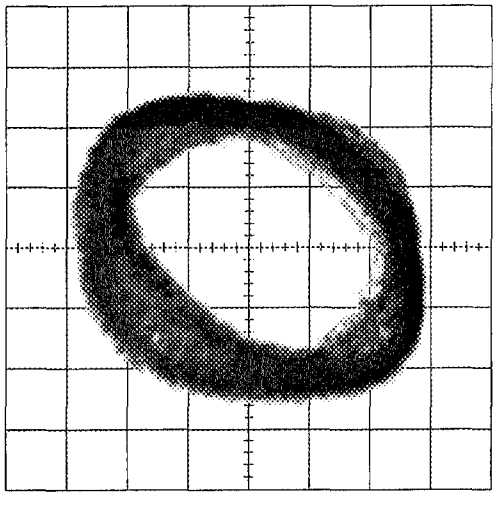
45°



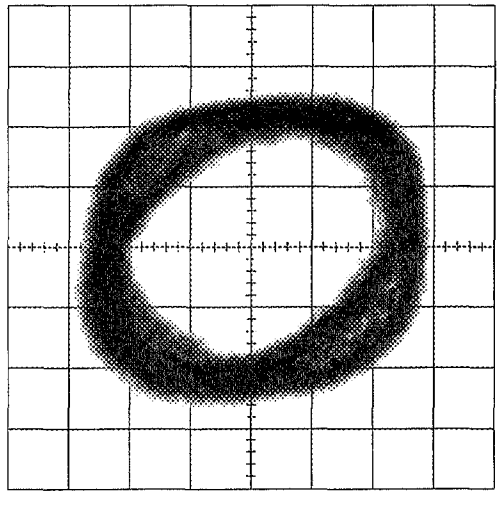
60°



75°



90°



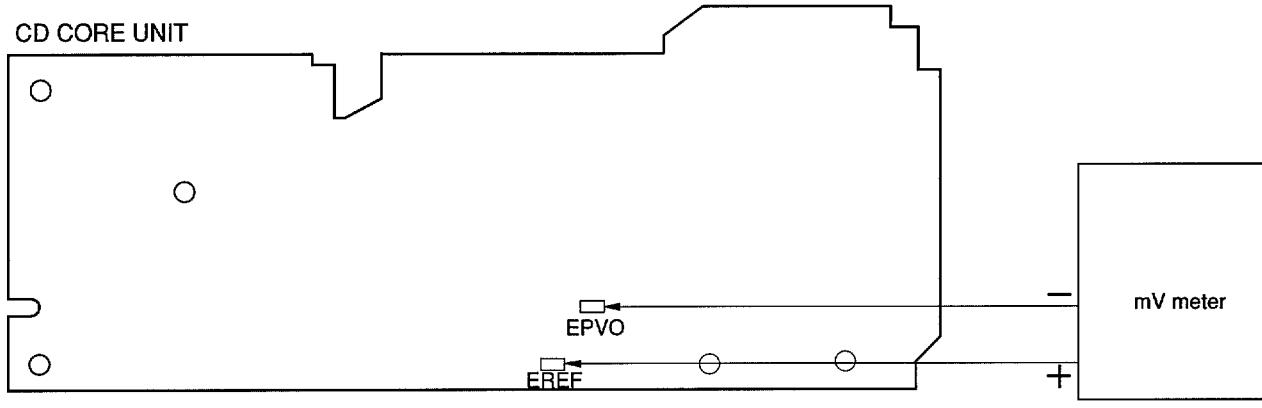
6.3 ADJUSTMENT OF ELEVATION WHEN THE CD CORE UNIT HAS BEEN REMOVED FOR MAINTENANCE

● Adjustment When Error Code 60 is Displayed Because of Malfunctioning Elevation

·**Note :**
Unlike the conventional mechanisms, the new mechanism detects the height of the stage using slide-variable resistance.
To absorb dislocation of the stage height caused by differences in the mechanism and the CD core unit, adjustment must be made for each CD-mechanism module using a variable resistor.
Normally, readjustment is not needed, as this has been adjusted at the factory. However, adjustment of elevation is required according to the procedure explained below if an elevation error has occurred or if the CD core unit has been removed.

·**Purpose :**
To adjust and confirm whether or not elevation operates correctly.

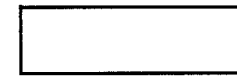
·**Adjustment Method :**
·Measuring Equipment: Millivoltmeter
·Measuring Points : EREF, EPVO
·Setting : Without a magazine in Test mode
With the mechanism placed upside-down (Place the CD mechanism module so that the CD core unit is above.)

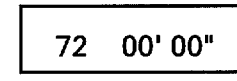


·**Confirmation Procedure**

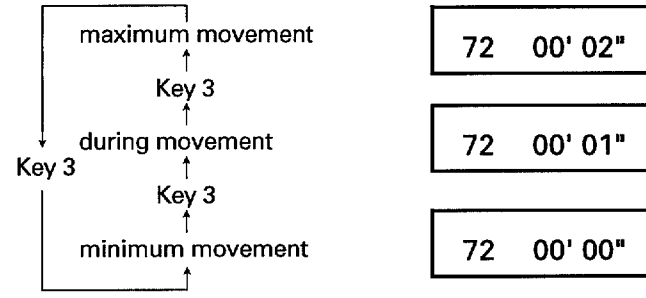
1. Enter Test mode, then select Multi-CD player.
2. Press key **1** to enter Mechanism Test mode.
3. Press key **3** twice to specify the amount of movement.

Examples of display





The amount of movement changes each time key **3** is pressed.



Examples of display

4. Press key **5**to set ELV/TRAY mode to TRAY.

72 01' 02"

5. Press key **UP** to release the clamp and return the tray to the magazine.

Release the clamp

6. Press key **5** to enter Elevation Move mode.

72 00' 02"

7. Use key **UP/DOWN** to operate elevation and set it to the graduation of the fourth step (Fig. 14).

8. Make the adjustment.
   Use VR802 to adjust the difference in potential between EREF and EPVO to 0 ±20 mV.

9. When adjustment is completed, press key **DIR** to exit Mechanism Test mode.

72 00' 02"

10. Confirm operation of the mechanism.
    Place the mechanism horizontally (CD core unit below). Take care not to short-circuit the P.C.B.

11. Confirm the height of the stage. Use the **4** key to select Disc No.4.
    Check if the stopper bend of the clamp lever is engaged in the groove of the frame stopper (Fig. 15-17).

04 00' 00"

·**Note :**
The stopper bend will be pressed downward into the groove for final clamping. Confirm the engagement position of the stopper bend.

·If the stopper bend is engaged in the center and pressed downward, adjustment is completed. Go to step 15.

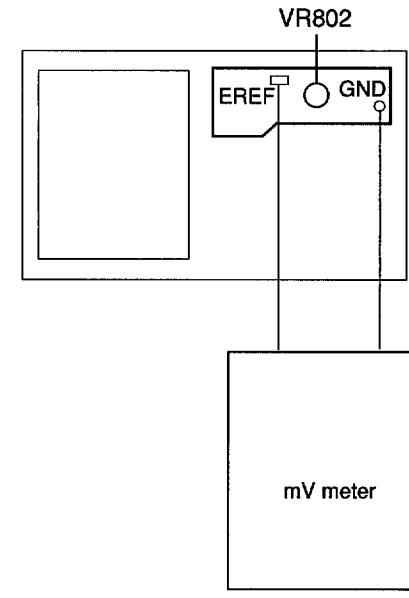
·If the stopper bend is dislocated, check the amount of dislocation by following steps 12 to 14.

12. To see the amount of dislocation, place the mechanism upside-down. If the stopper bend has been dislocated in the direction of the first CD, turn VR802 to the left(fig 15).

    To lower the stage toward the sixth step by 0.1 mm, reduce the voltage of EREF (adjusted in step 8) by 20 mV.

    If the stopper bend has been dislocated in the direction of the sixth CD, turn VR802 to the right(fig 17).

    To raise the stage toward the first step by 0.1 mm, increase the voltage of EREF (adjusted in step 8) by 20 mV.



13. Place the mechanism horizontal. Go back to step 11 to reconfirm the stage height.

14. When adjustment of the stage height is completed, proceed as follows:

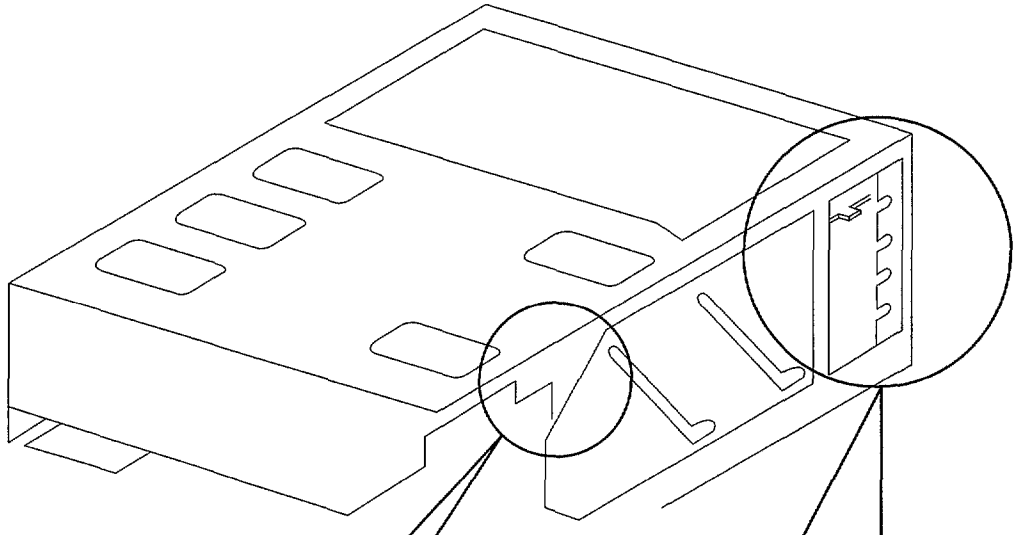
15. Press the **EJECT** switch.

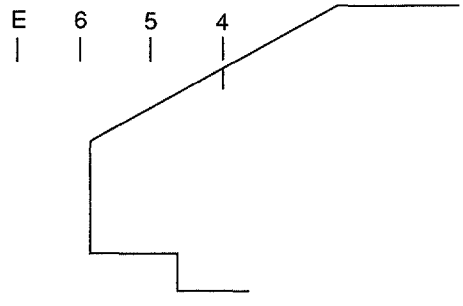
16. Once operation of the mechanism has stopped, turn the power OFF.

17. Wait more than one minute after the power is turned off, then turn the power ON and insert a magazine.

18. Check if the mechanism operates correctly with the first and fourth CDs.

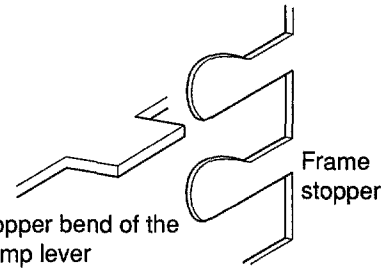
19. If the mechanism operates properly, adjustment is completed. If the mechanism operates improperly, make the adjustment again.





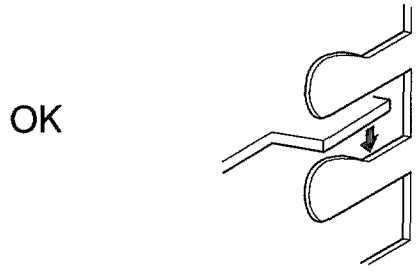
Adjust to graduation of the fourth CD.

Fig.14



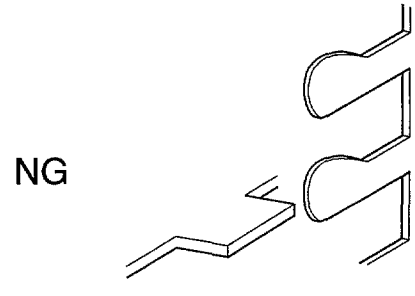
Dislocated toward the first CD.

Fig.15



Engaged in the center and pressed downward.

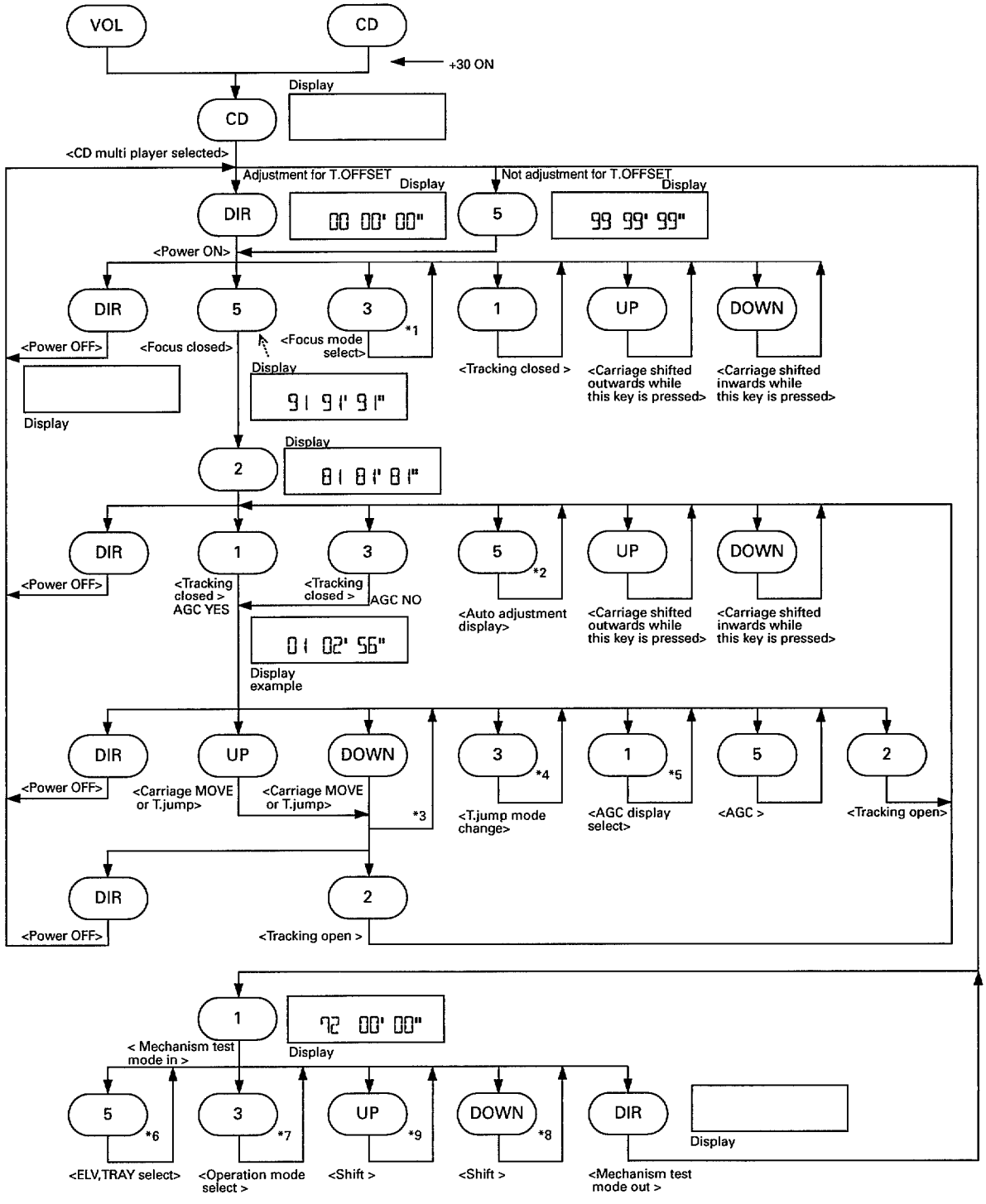
Fig.16



Dislocated toward the sixth CD.

Fig.17

6.4 FLOW CHART



*1 Normal focus close → S curve check → Focus EQ check
00 00' 00" Display 01 01' 01" 02 02' 02"

*2 Normal display → Focus cancel → Tracking offset → Tracking balance (Close spindle-rough)

*3 100 TRK jump & carriage MOVE continue only while the keys are pressed

*4 SINGLE → 4TRK → 10TRK → 32TRK → 100TRK → C.MOVE
81 Display 82 83 84 85 86

*5 Normal display → Focus gain → Tracking gain → Focus bias

*6 ELV motor select → TRAY motor select
72 00' 0X" Display 72 10' 0X"

*7 ELV select: 8ms pulse drive → 24ms pulse drive → DC drive
72 00' 00" Display 72 00' 01" 72 00' 02"

TRAY select: 48ms pulse drive → 200ms pulse drive → DC drive
72 10' 00" Display 72 10' 01" 72 10' 02"

*8 ELV select : ELV dowm (Disc 1 to 6)
TRAY select : TRAY out

*9 ELV select : ELV up (Disc 6 to 1)
TRAY select : TRAY in

● Error Number Indication

If the CD should fail to operate or if an error has taken place during operation the player will enter into the error mode, and the cause of the error will be numerically indicated.

This is aimed at assisting in analysis or repair.

(1) Basic Means of Display

·Examples of Display ERROR-XX

(2) Error Codes

Error Code	Classification	Description	Cause/Detail
10	ELECTRIC	Carriage home failure	Carriage doesn't move to or from the innermost position →Home switch failed and/or carriage immobile
11	ELECTRIC	Focus failure	Focus failed →Defects, disc upside-down, severe vibration
12	ELECTRIC	SETUP failure Subcode failure	Spindle failed to lock or subcode unreadable →Spindle defective, defect, severe vibration
14	ELECTRIC	Mirror failure	Unrecorded CD-R The disc is upside-down, defects, vibration
17	ELECTRIC	Set up failure	AGC protect failed →Defects, disc upside-down, severe vibration
19	ELECTRIC	Set up failure	Tracking error waveform is too unbalanced (>50%) or level is too small →The P.U.unit or tracking error circuitry is N.G.
30	ELECTRIC	Search time out	Failed to reach target address →Carriage/tracking defective and/or defects
A0	SYSTEM	Power failure	Power overvoltage or short circuit detected →Switching transistor defective and/or power abnormal
A1	SYSTEM	Mechanism power failure	Mechanism elevation reference voltage is out of prescription →EREF adjustment VR and/or power abnormal
50	MECHANISM	An error upon ejection	MAG switch release time has time out Elevation time out when eject
60	MECHANISM	An error while putting in and out the tray	Tray in / out time has time out Tray is caught when put in
70	MECHANISM	An error upon elevation	Elevation time has time out
80	MECHANISM	An error with an empty magazine inserted	No disc is available

* Setup means a series of operations after focusing up to sound output.

7. GENERAL INFORMATION

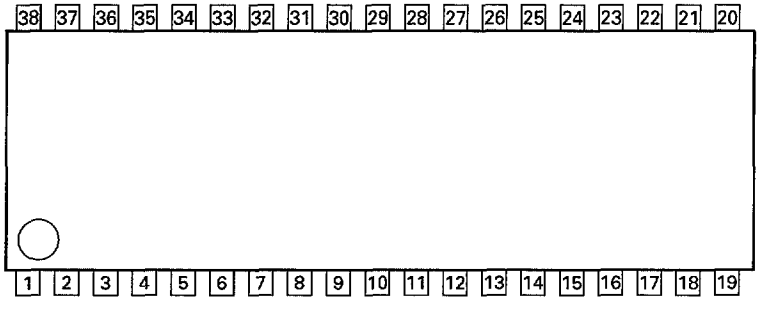
7.1 PARTS

7.1.1 IC

● **Pin Functions (UPC2572GS)**

Pin No.	Pin Name	I/O	Function and Operation
1	EFM-IN	I	EFM comparator input
2	AGC-OUT	O	AGC amplifier output
3	C. AGC		Connects AGC peak detection condenser
4	RF-IN	I	RF signal DC component cut input
5	RF-OUT	O	RF amplifier output
6	RF-	I	RF amplifier inverted input
7	C1, 3T		Connects RF3T component detection condenser
8	C2, 3T		Connects RF3T component detection condenser
9	Vcc		Power supply
10	A	I	A signal input
11	C	I	C signal input
12	B	I	B signal input
13	D	I	D signal input
14	F	I	F signal input
15	E	I	E signal input
16	PD	I	APC amplifier input
17	LD	O	APC amplifier output
18	LDON	I	Laser diode ON/OFF input
19	VREF-OUT	O	Reference voltage output
20	VREF-IN	I	Reference voltage input
21	DET-OUT	O	Vibration detection circuit output
22	DET-IN	I	Vibration detection circuit input
23	TE-OUT2	O	Tracking error amplifier output (fourfold gain)
24	TE-OUT1	O	Tracking error amplifier output (singlefold gain)
25	TE-	I	Tracking error amplifier inverted input
26	GND		GND
27	FE-	I	Focus error amplifier inverted input
28	FE-OUT	O	Focus error amplifier output
29	C.FE	I	Focus error signal DC component cut input
30	3T-OUT	O	RF3T component output
31	MIRR	O	MIRR signal output
32	RFOK	O	RFOK signal output
33	DEFECT	O	DEFECT signal output
34	C. DEF		Connects DEFECT signal detection condenser
35	EFM-OUT	O	EFM comparator output
36	ASY	I	EFM comparator level input
37	TE-BAL	I	Tracking balance control
38	FE-BAL	I	Focus balance control

UPC2572GS

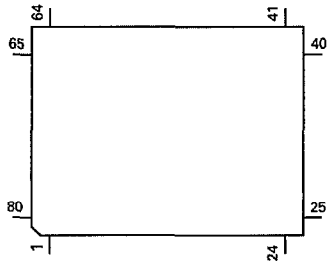


● Pin Functions (UPD63702GF)

Pin No.	Pin Name	I/O	Function and Operation
1	D.VDD		Supplies current of positive voltage to the logic circuits
2	$\overline{RST}$	I	System reset input pin
3	AO	I	Microcomputer interface AO="L": $\overline{STB}$ active and set to address register AO="H": $\overline{STB}$ active and set to parameter
4	$\overline{STB}$	I	Signal to latch serial data within the LSI
5	$\overline{SCK}$	I	Clock input pin to input and output serial data
6	SO	O	Outputs serial data and status signal
7	SI	I	Serial data input pin
8	D.GND		Logic circuit GND
9	X.GND		Crystal oscillation circuit GND
10	XTAL	I	Crystal oscillator connection pin
11	$\overline{XTAL}$	O	Crystal oscillator connection pin
12	X.VDD		Supplies current of positive voltage to the crystal oscillation circuit
13	DA.VDD		Supplies current of positive voltage to the D/A converter
14	R+	O	Right channel analog audio data output pin
15	R-	O	Right channel analog audio data output pin
16,17	DA.GND		D/A converter GND
18	L-	O	Left channel analog audio data output pin
19	L+	O	Left channel analog audio data output pin
20	DA.VDD		Supplies current of positive voltage to the D/A converter
21	D.VDD		Supplies current of positive voltage to logic circuit
22	FLAG	O	Flag output pin to indicate that audio data currently being output consists of noncorrectable data
23	WDCK	O	Pin to output double the frequency of LRCK
24	C16M	O	Pin to output the clock
25	EMPH	O	Output pin for the pre-emphasis data in the sub-Q code
26	DIN	I	Input pin for serial audio data
27	DOUT	O	Output pin for the serial audio data
28	SCKO	O	Output pin for the clock for the serial audio data
29	LRCK	O	Signals to distinguish the right and left channels of the audio data output from DOUT. Frequency is 44.1kHz at 50% duty at normal regeneration
30	TX	O	Output pin for the digital audio interface data
31	CTLV	I	Oscillation control pin for high-frequency clock generation VCO used for the digital PLL upon regeneration at fast speed of 2- or 4-fold
32	POUT	O	Output point for phase comparison
33	D.GND		GND for the logic circuit
34	VCO	I	Input pin for the inverter
35	$\overline{VCO}$	O	Output pin for the inverter
36	D.VDD		Supplies current of positive voltage to the logic circuit
37	PLCK	O	Pin for monitoring the bit clock
38	LOCK	O	Indicates "H" when the synchronized pattern detection signal matches the frame counter output at the EFM recovery modulation, and "L" when they don't match
39	WFCK	O	Minute-cycle signal for the bit clock, the signal indicates the cycle of 1 frame (approx. 7.35kHz)
40	RFCK	O	Minute-cycle signal for the clock, the signal indicates cycle of 1 frame (approx. 7.35kHz)
41	D.GND		GND for the logic circuit
42,43	TEST0,1	I	Test pins
44,45	TM2, TM4	I	Pins for controlling regeneration at fast speed of 2- or 4-fold
46-49	T4-T7	I	Test pins
50,51	C1D1, C1D2	O	Output pin for indicating the C1 error correction results
52-54	C2D1-C2D3	O	Output pin for indicating the C2 error correction results
55	D.VDD		Supplies current of positive voltage to the logic circuit
56	SFSY	O	Outputs 1 word of the subcode. Generally, 1 cycle is approx 136 micro seconds
57	SBSY	O	The signal indicates the beginning of the subcode block. The SFSY signal is output at high level every 98 times
58	SBSO	O	Output pin for the subcode data

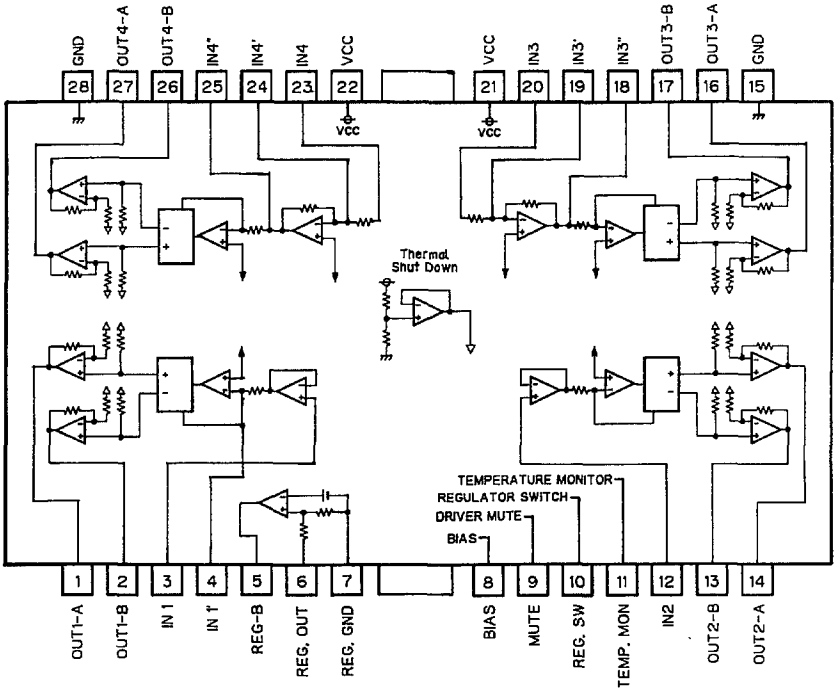
Pin No.	Pin Name	I/O	Function and Operation
59	SBCK	I	Input pin for the clock signal for read-out of the subcode data
60	A.GND		GND for the analog circuit
61	MD	O	Output pin for the spindle drive
62	SD	O	Output pin for the sled drive
63	TD	O	Output pin for the tracking drive
64	FD	O	Output pin for the focus drive
65	FBAL	O	Output pin for the focus balance control
66	TBAL	O	Output pin for the tracking balance control
67	A.VDD		Supplies current of positive voltage to the analog circuit
68	TBC	I	Switches coefficient banks for the tracking filter
69	EFM	I	Input pin for the EFM signal
70	HOLD	I	Input pin for the hold control signal
71	RFOK	I	Input pin for the RFOK signal
72	MIRR	I	Input pin for the MIRR signal
73	A.GND		GND for the analog circuit
74	HOME	I	Home position detector input
75	VR1	I	The signal input through these pins is digitized to 8-bit by the A/D converter, which by operation of the assigned register, can be read into the microcomputer
76	FE	I	Inputs a focus-error signal from the RF amplifier
77	TE	I	Inputs a tracking-error signal from the RF amplifier
78	TEC	I	Input pin for the tracking comparator
79	REFOUT	O	Output point for midpoint potential for the A/D converter for the LSI portion
80	A.VDD		Supplies current of accurate voltage to the analog circuit

*UPD63702GF

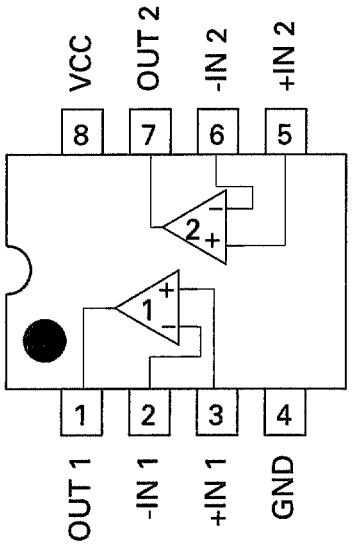


IC's marked by are MOS type.*
Be careful in handling them because they are very liable to be damaged by electrostatic induction.

XLA6997FM



XLA4560F

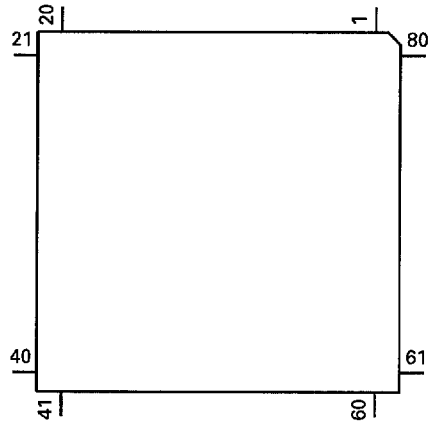


● **Pin Functions (PD5376A)**

Pin No.	Pin Name	I/O	Format	Function and Operation
1	VDIN	I		Power supply short sensor input
2	DORILM	O	C	EJECT door illumination output
3–5	NC			Not used
6	XA0	O		Control signal distinguishing data from LSI
7	XSCK	O	C	LSI clock output
8	XSO	O	C	LSI data output
9	XSI	I	C	LSI data input
10	$\overline{\text{XSTB}}$	O	C	LSI strobe output
11	$\overline{\text{XRST}}$	O	C	LSI reset output
12	$\overline{\text{DCE}}$	O	C	Not used
13	NC			Not used
14	$\overline{\text{WUP}}$	I		Bus wakeup interrupt input
15	$\overline{\text{BSENS}}$	I		Back up power sense input
16	$\overline{\text{INT}}$	I		Interrupt input from CAN-BUS IC
17	NC			Not used
18	ECE	O	C	Chip enable output for EEPROM
19	ECK	O	C	Clock output for EEPROM
20	EDO	O	C	Serial data output for EEPROM
21	EDI	I		Data input from EEPROM
22	$\overline{\text{EJSW}}$	I		Eject switch Interrupt input
23	$\overline{\text{MAG}}$	I		Magazine lock switch interrupt input
24	NC			Not used
25	$\overline{\text{RESET}}$	I		Reset input
26	$\overline{\text{POWER}}$	O	C	CD +5V control output
27	CONT	O	C	Servo driver power supply control output
28	XIN	I		Crystal oscillating element connection pin
29	XOUT	O		Crystal oscillating element connection pin
30	VSS			GND
31–38	NC			Not used
39	CANPOW	O	C	Power supply control output for CAN-BUS IC
40	$\overline{\text{ASTB}}$	O	C	Address strobe output for CAN-BUS IC
41	$\overline{\text{WAIT}}$	I		Wait signal input for CAN-BUS IC
42	$\overline{\text{WR}}$	O	C	Write signal input for CAN-BUS IC
43	$\overline{\text{RD}}$	O	C	Read signal output for CAN-BUS IC
44	$\overline{\text{RST}}$	O	C	CAN-BUS IC reset
45	$\overline{\text{CS}}$	O	C	Chip select output for CAN-BUS IC
46	A8	O	C	Address output for CAN-BUS IC
47–54	AD7-AD0	I/O	C	Address/data input/output for CAN-BUS IC

Pin No.	Pin Name	I/O	Format	Function and Operation
55	NC			Not used
56	$\overline{6}$/12	I	C	6/12 switching input
57	NC			Not used
58	MIRR	I	C	Mirror detector input
59	LOCK	I	C	Spindle lock detector input
60	FOK	I	C	FOK signal input
61	$\overline{\text{CMSEL}}$	I		Compression select input
62–64	NC			Not used
65	I1,3	O	C	Motor driver control output
66	I2	O	C	Motor driver control output
67	I4	O	C	Motor driver control output
68	CDMUTE	O	C	CD mute output
69	$\overline{\text{ADENA}}$	O	C	A/D converter reference voltage output
70	$\overline{\text{TESTIN}}$	I	C	Test program mode input
71	VCC			Power supply terminal
72	VREF			A/D converter reference voltage input
73	AVSS			A/D converter GND
74,75	NC			Not used
76	$\overline{\text{DISK}}$	I		Disc detector input
77	ELVPVO	I		Voltage input from ELV position sense
78	ELVREF	I		ELV reference voltage input
79	MSW	I		Disc sense timing input and tray position input
80	TEMP	I		Temperature detector

*PD5376A



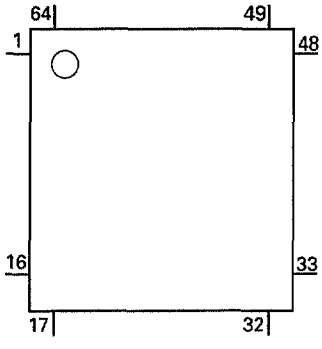
Format	Meaning
C	C MOS

● Pin Functions GGC1191(UPD72005GC(A))

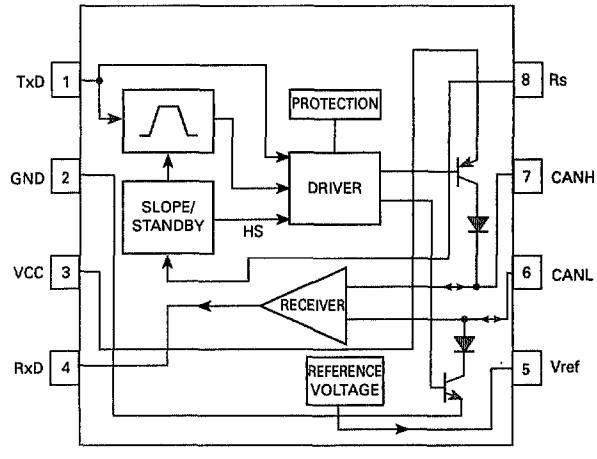
Pin No.	Pin Name	I/O	Function and Operation
1	RX1	I	Input data of CAN BUS
2	RX0	I	Input data of CAN BUS
3	AVSS		A/D GND
4	AVDD		Positive power supply terminal for analog circuit
5	TX1	O	Output data of CAN BUS
6	TX0	O	Output data of CAN BUS
7	VSS		GND
8	VDD		Power supply
9	BSSEL	I	Select port for inter face
10	$\overline{\text{WAIT}}$	O	Memory access WAIT signal
11	ASTB	I	Memory access address T signal
12	$\overline{\text{RD}}$	O	Memory access WAIT signal
13	$\overline{\text{WR}}$	O	Memory access WAIT signal
14	$\overline{\text{CS}}$	I	Memory access chip select pin
15	A8	I	Address line bit 8

Pin No.	Pin Name	I/O	Function and Operation
16–23	D7-0	I/O	Address data bit 7
24–27	KDT0-3	I	Key data input
28–31	KST0-3	O	Key strobe output
32	VDD		Power supply
33	VSS		GND
34	F/R	O	Cassette mechanism head forward/reverse select output
35	PLAY	O	Tape MS filter select output
36	NR	O	NR output
37	SC2	O	Cassette mechanism sub motor control output
38	SC1	O	Cassette mechanism sub motor control output
39	CM	O	Cassette mechanism capstan motor control output
40	STBY	I	Stand-by input terminal
41	WKUP	O	BUS wake up output
42	INT	O	Squeeze signal output
43	IC		GND
44	RESET	I	Reset input
45	VDD		Power supply
46	VSS		GND
47	X1		Crystal oscillator connection pin
48	X2		Crystal oscillator connection pin
49	CVSS		Clock VSS
50	CVDD		Clock VDD
51	REL	I	Cancellation port of stop mode
52	CKSEL	I	Master clock frequency select input

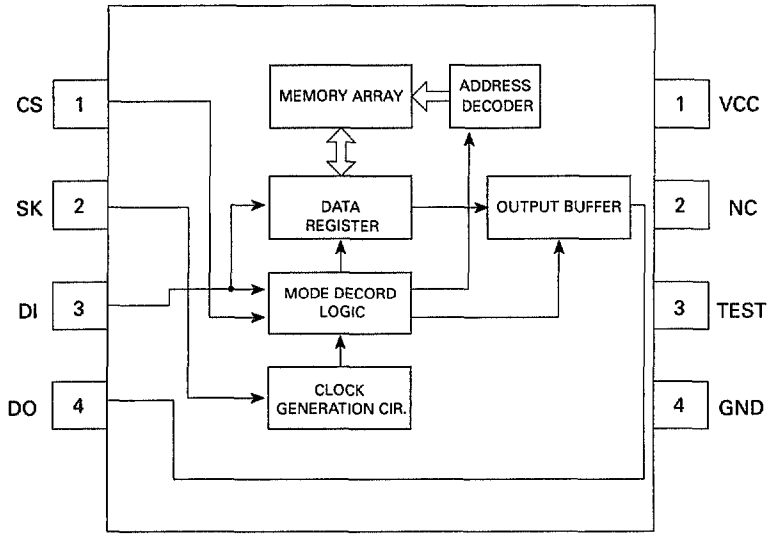
*GGC1191(UPD72005GC(A))



PCA82C250T



S-29220A



7.2 DIAGNOSIS

7.2.1 DISASSEMBLY

● Removing the Upper Case

1.Remove the two screws A and then remove the cover.
2.Remove the eight screws B and then remove the upper case.

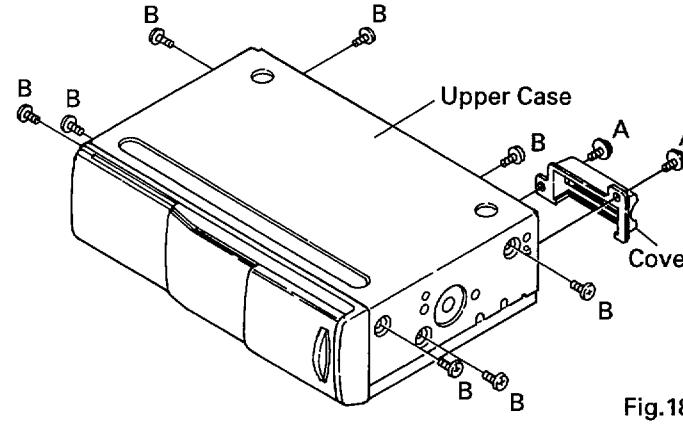


Fig.18

● Removing the CD Mechanism Module

1.Remove the four dampers.
2.Remove the two springs.
3.Disconnect the connector A and then remove the CD mechanism module.

● Removing the Grille Unit

1.Remove the two screws C.
2.Disconnect the connector B.
3.Press the two tabs indicated by arrows and then pull out the grille unit.

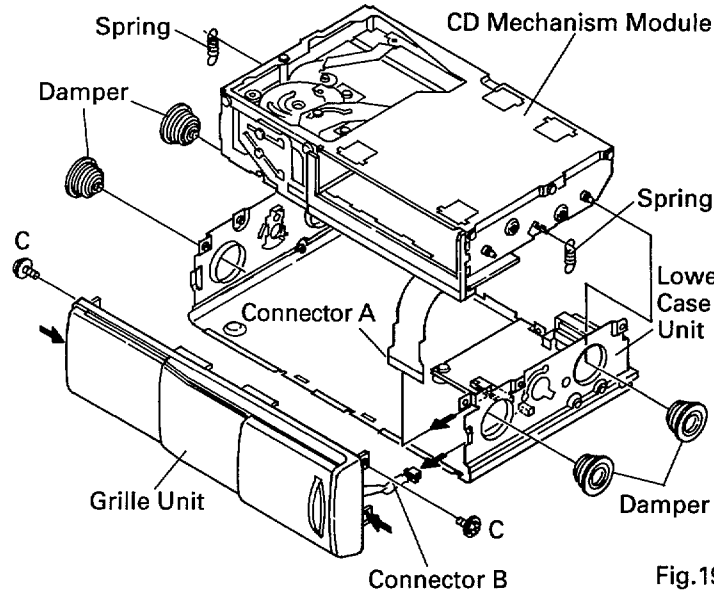


Fig.19

● Removing the Control P.C.Board

1.Remove the two screws D and the screw E.
2.Stretch the claw indicated by arrow and then remove the control PCB

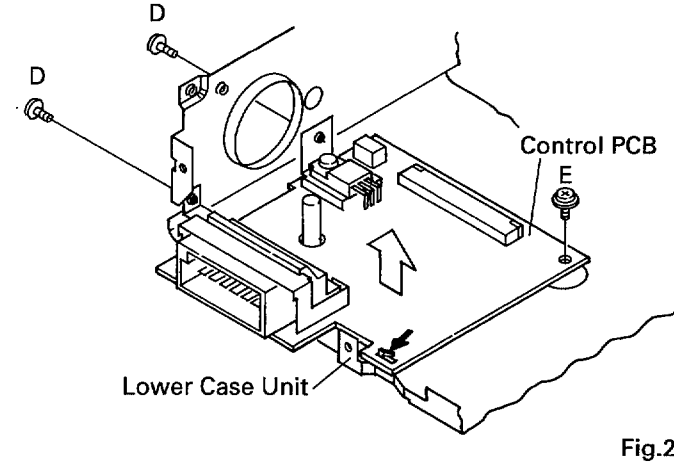


Fig.20

● Precautions for Replacement of P.C.Board

Be sure to install the PCB in the correct direction, as shown in the figure below. The system does not operate correctly direction is reversed.

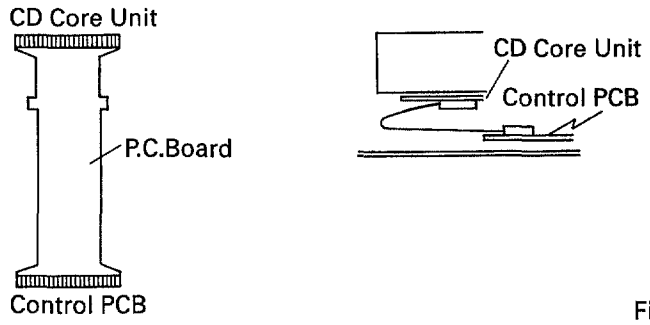


Fig.21

● Precautions for Replacement of damper

When inserting the damper into the CD mechanism module, be sure to insert the damper until it hits portion A.

Incomplete insertion of the damper into the CD mechanism module causes improper operation of the CD mechanism module.

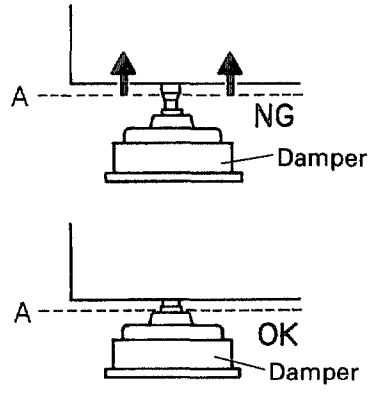


Fig.22

7.3 BLOCK DIAGRAM

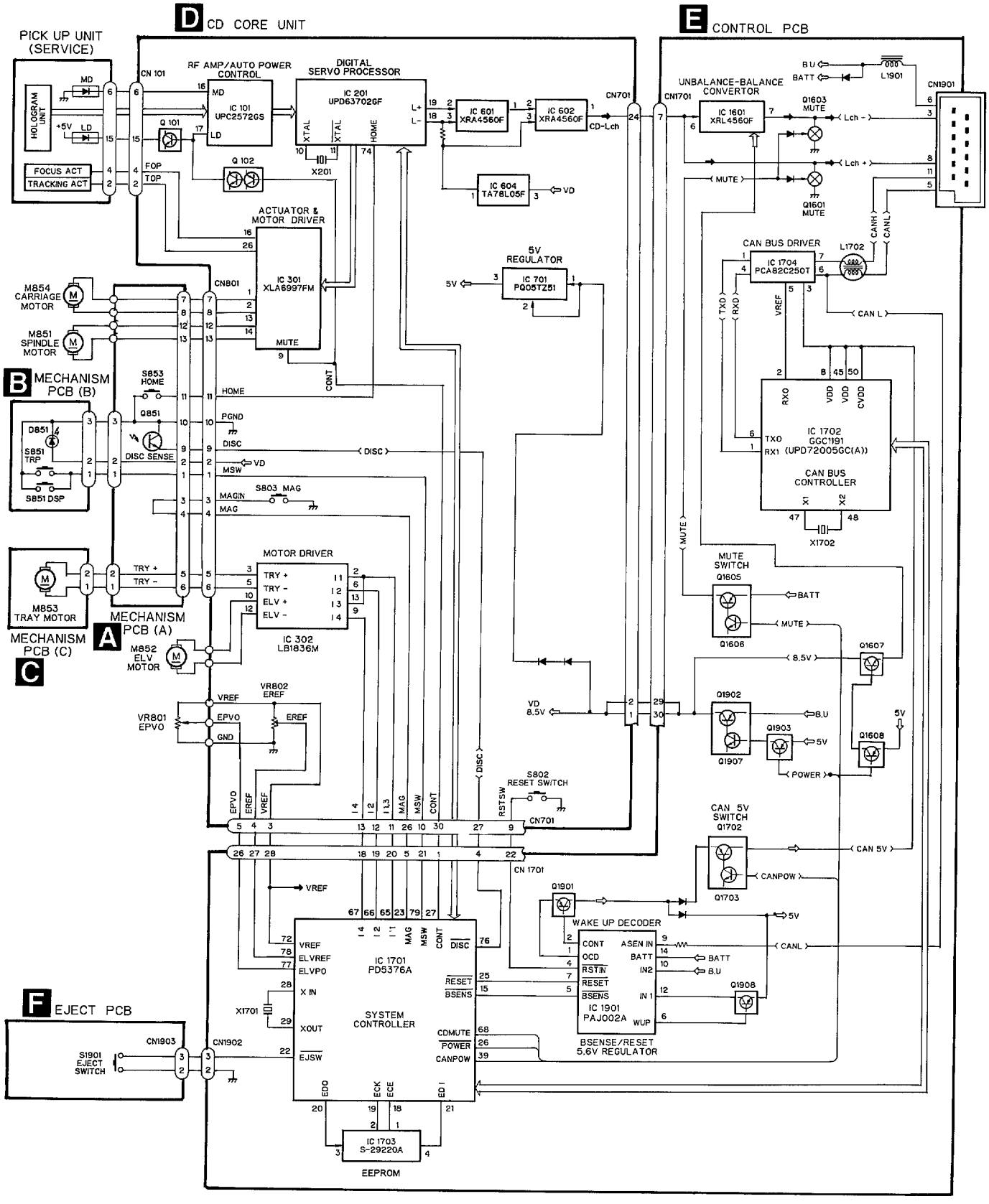


Fig.23

7.4 SYSTEM BLOCK DIAGRAM

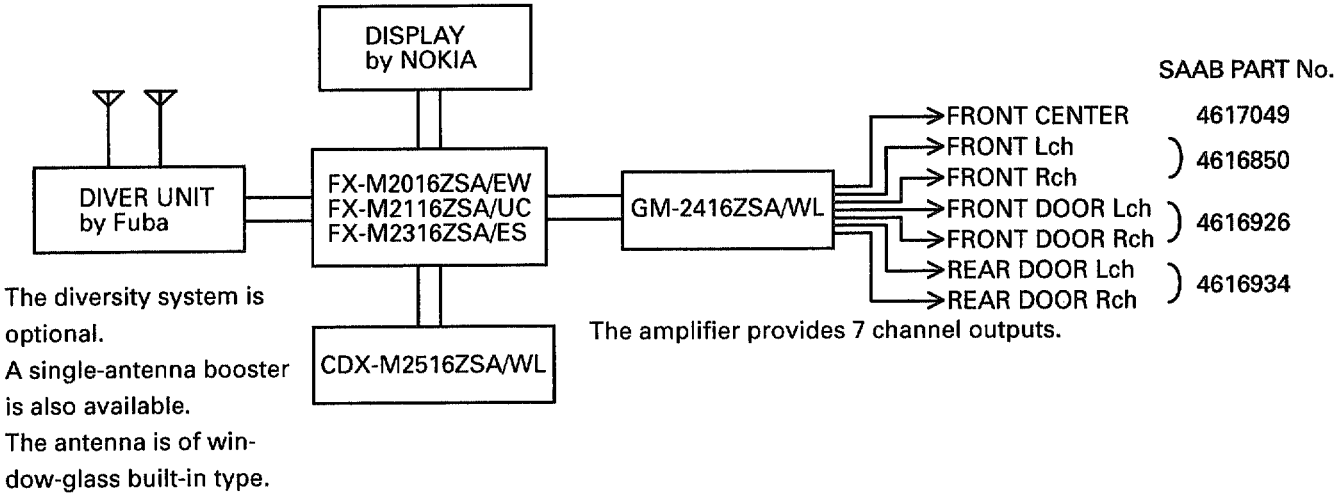


Fig.24

7.5 JIG

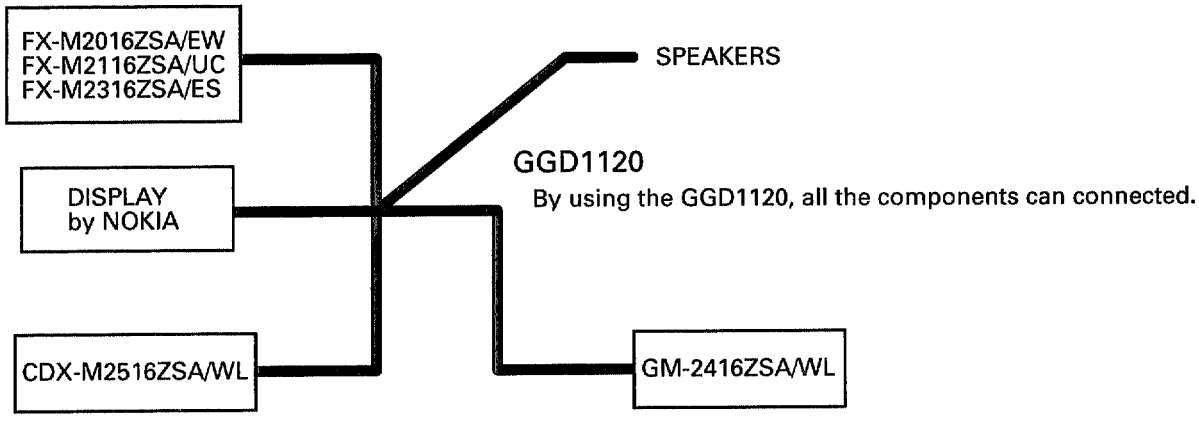
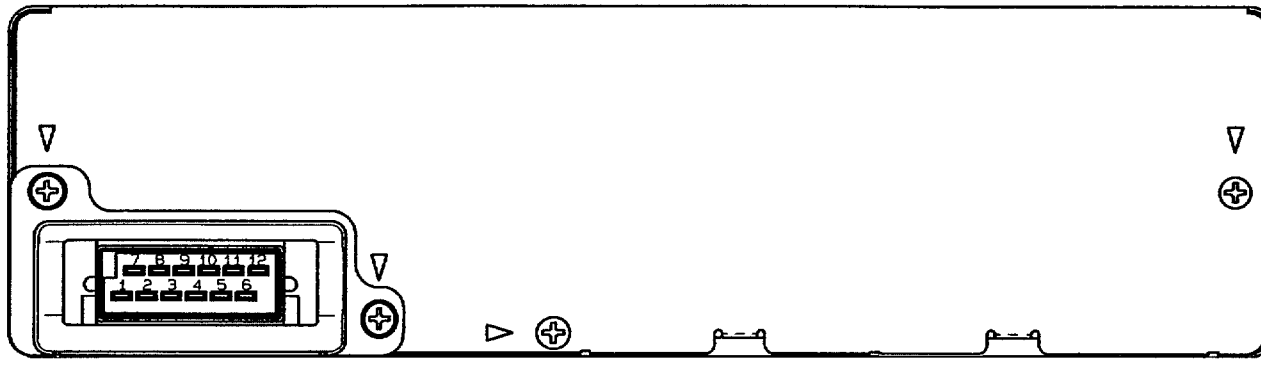


Fig.25

7.6 CONNECTOR FUNCTION DESCRIPTION

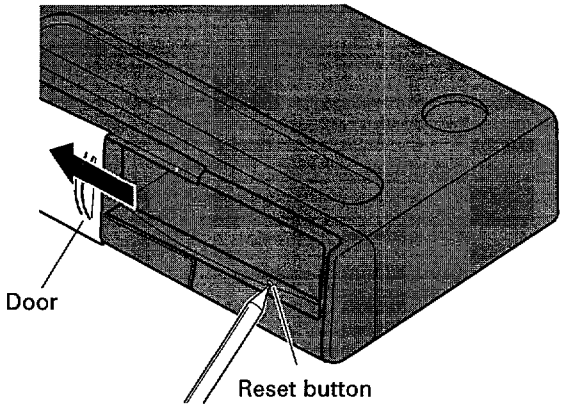


CONNECTOR PIN LOCATION

pin 1	NC
pin 2	-R
pin 3	-L
pin 4	NC
pin 5	CAN Low
pin 6	+30 (Battery)
pin 7	+R
pin 8	+L
pin 9	Not Used (Audio GND)
pin 10	NC
pin 11	CAN High
pin 12	GND

Fig.26

8. OPERATIONS AND SPECIFICATIONS



SPECIFICATIONS

General

System .....Compact disc audio system
Usable discs.....Compact disc
Signal format .....Sampling frequency: 44.1 kHz
Number of quantization bits: 16; linear
Power source.....13.0V
(10.5V — 15.6V allowable)
Weight 1.9kg
Dimensions.....254(W) x 70(H) x 174(D)mm

Audio

Signal-to-noise ratio.....more than 85dB(1kHz)
Distortion .....less than 0.03%
Dynamic range.....more than 85dB(1kHz)
Output level.....1.5 ± 0.15V(1kHz, 0dB)
Number of channels.....2(stereo)

PIONEER®
The Art of Entertainment

Service Manual

ORDER NO.
CRT1857

CD MECHANISM MODULE

CX-652

- **This service manual describes operation of the CD mechanism incroporated in models listed in the table below.**
- **When performing repairs use this manual together with the specific manual for model under repair.**

Model	Service Manual	CD Mechanism Module	CD Mechanism Unit
CDX-P626S/UC	CRT1854	CXK4410	CXA9005
CDX-P620S/UC, ES, EW	CRT1854	CXK4400	CXA9005
CDX-FM629S/UC	CRT1858	CXK4410	CXA9005
CDX-FM627S/UC, ES, EW	CRT1858	CXK4400	CXA9005
CDX-FM623S/UC, ES, GB	CRT1859	CXK4400	CXA9005

CONTENTS

1. SERVICING PRECAUTIONS 2
2. DISASSEMBLY 2
3. MECHANICAL DESCRIPTION 6
4. CIRCUIT DESCRIPTION 11

PIONEER ELECTRONIC CORPORATION 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan
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K-FFD. JUNE 1996 Printed in Japan

1. SERVICING PRECAUTIONS

1) Do not carry out any work holding the upper surface of the magazine insert slot on the mechanism, marked by an arrow, since it deforms easily.
2) When the Stage Mechanism is positioned below the 5th level, it protrudes below the chassis. Do not leave it in this position as it may become damaged.

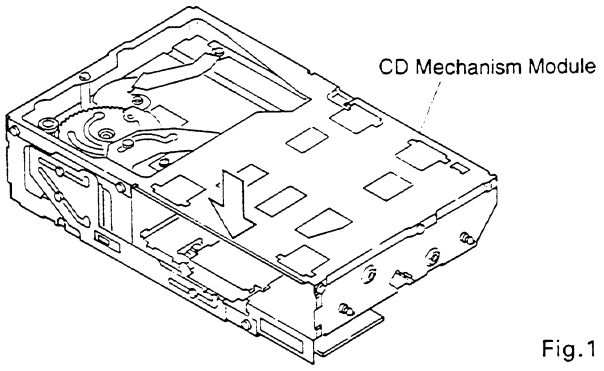


Fig.1

2. DISASSEMBLY

● Removing the Pick-up Unit

1. Attach the Short Pin onto the Flexible P.C.Board of the Pick-up Unit.(Fig.2)
2. Remove the Flexible P.C.Board from the connector.(Fig.2)
3. Remove the Torsion Spring which is pressed against the leading edge of the Feed Screw.(Fig.3)
4. Remove the Screw and Pulley Cover.(Fig.3)
5. Remove the Belt and the Pick-up Unit with the Feed Screw still attached.(Fig.3)
6. Lift the Tabs of the rack section of the Holder and remove the Feed Screw. While doing so, be careful not to lose the Bearings on the ends of the Feed Screw.(Fig.3)

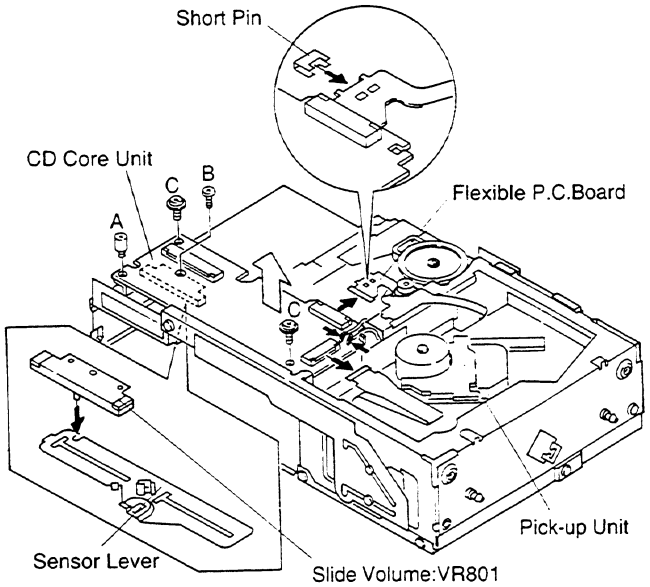


Fig.2

● Removing the CD Core Unit (Fig.2)

1. After procedures 1 and 2 for removing the Pick-up Unit, remove the connector.
2. Remove the Elevation Motor Assy lead wires marked with an arrow which are soldered onto the CD Core Unit.
3. Remove screw (A), screw (B) and screws (C)(2 screws), then remove the CD Core Unit.

● Precautions for Installing the CD Core Unit

If the sensor lever of the Linear Position Sensor (Slide Volume: VR801) of the CD Core Unit is not inserted properly in the U-shaped Groove the elevation operation may not function properly. When installing the CD Core Unit in the CD Mechanism Unit insert the Linear Position Sensor (Slide Volume: VR801) securely in the U-shaped Groove.

● Removing the Carriage Motor Assy (Fig.3)

1. After procedures 3 and 4 for removing the Pick-up Unit, remove the Belt, and the Carriage Motor Assy.

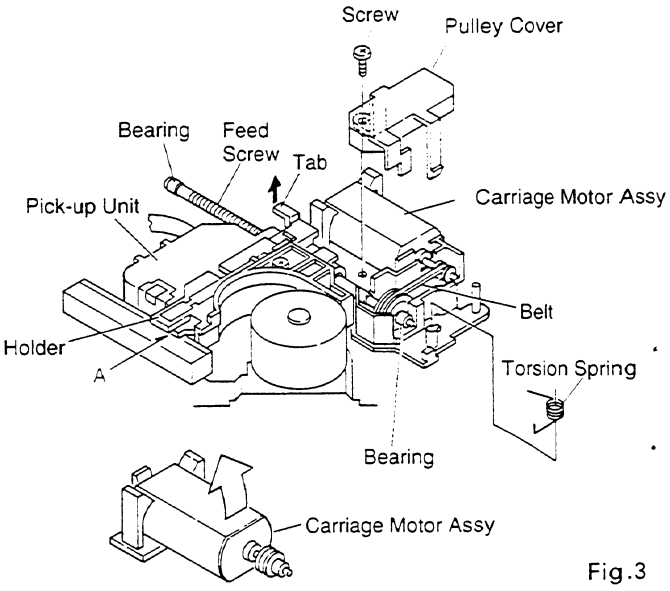


Fig.3

● Removing the Spindle Motor Assy

1. Turn the Tray Motor using an 8V DC voltage supply, and move the Tray Extending Arm.
2. Remove screw (D) and remove the Clamp Spring.
3. Remove the Clamper.
4. Remove the two screws (E) and remove the Spindle Motor.

● Precautions for Installing the Spindle Motor Assy

When installing the Spindle Motor Assy be sure the lead wires trail forward the magazine insert slot. Furthermore, make sure that the Side Pressure Holder is correctly pressed against the Shaft.

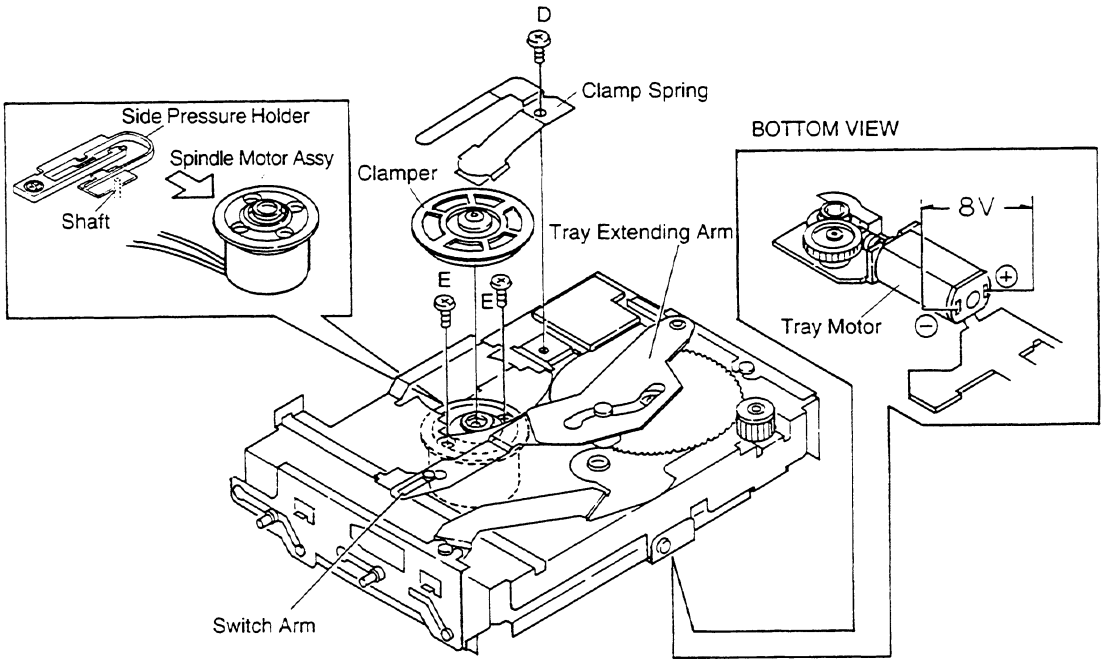


Fig.4

● Removing the Tray Motor Assy

1. Remove screw (F).
2. Remove the Polyslider and the Two-level Gear.
3. By moving the Front Lever, bring the Stage Mechanism to the position between markings "6" and "E" on the Front Lever.
4. Remove screw (G).
5. Moving the Front Lever again, bring the Stage Mechanism to the highest level.
6. Remove the Tray Motor Bracket (not shown in diagram).
7. Remove the two screws and remove the Tray Motor Assy (not shown in diagram).

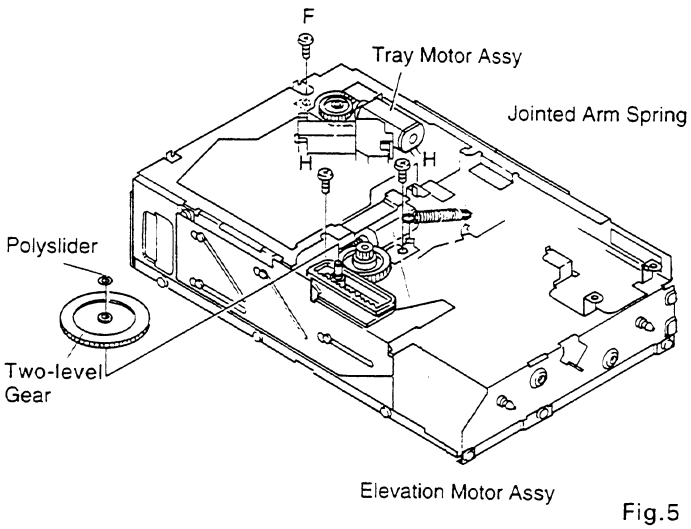


Fig.5

● Removing the Elevation Motor Assy

1. Remove the Jointed Arm Spring.
2. Remove the two screws (H) and remove the Motor Bracket.
3. Remove the two screws and remove the Elevation Motor Assy (not shown in diagram).

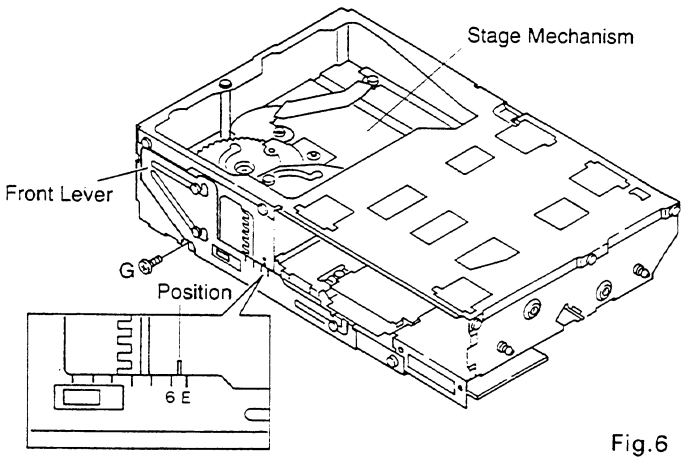


Fig.6

● Removing the Stage Mechanism

1. Remove the Two-level Gear.
2. Remove the screw (J), and remove the Rack.
3. When the Front Lever is moved until the Stage Mechanism is at its lowest position, the Front Lever, Rear Lever and Sensor Lever may all be removed at the same time.
4. Remove the nine screws (K), and screw (L) and then remove the Upper Frame. Do this carefully, as the Coil Spring of the Multiple Insertion Prevention Mechanism may fall off.
5. Remove the five screws (M) and screw (N) and remove the Stage Mechanism by separating the front and back of the Frame.

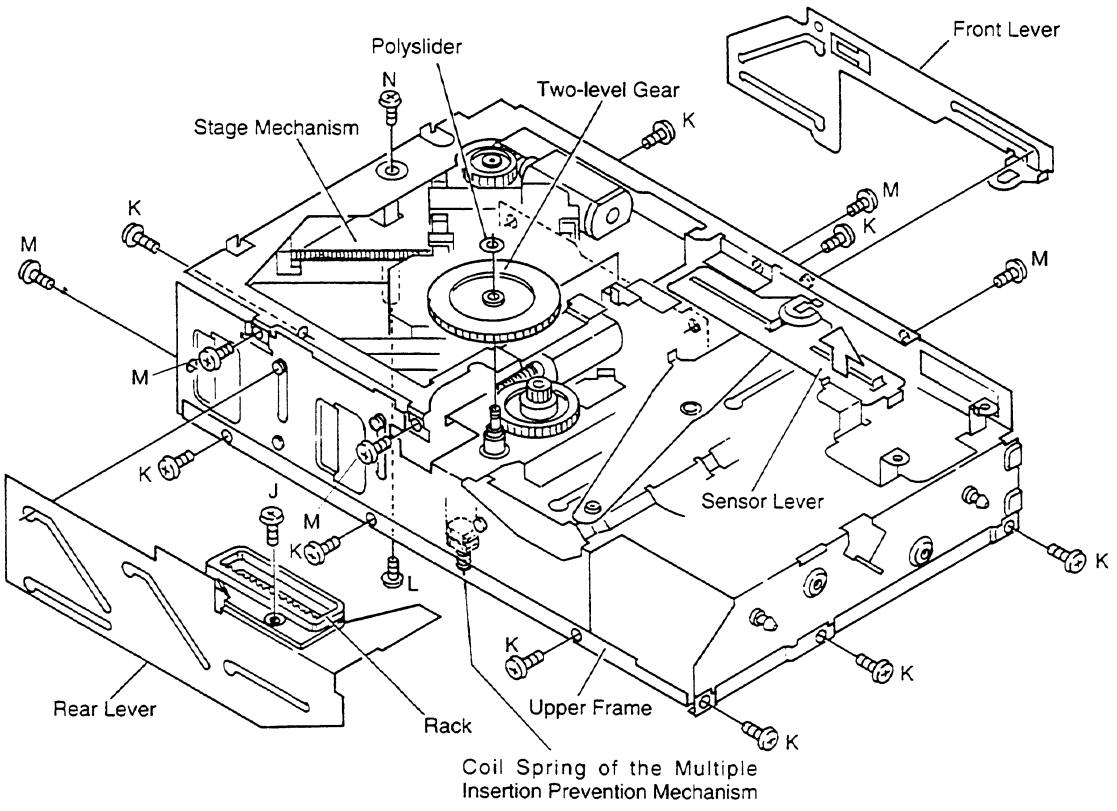


Fig.7

3. MECHANICAL DESCRIPTION

● Inserting the Magazine

1. Inserting the magazine while countering the spring force of the EJECT Lever, the Lock Arm will slide along the groove on the reverse side of the magazine and lock into place (due to the Torsion Spring on the reverse side of the Lock Arm).

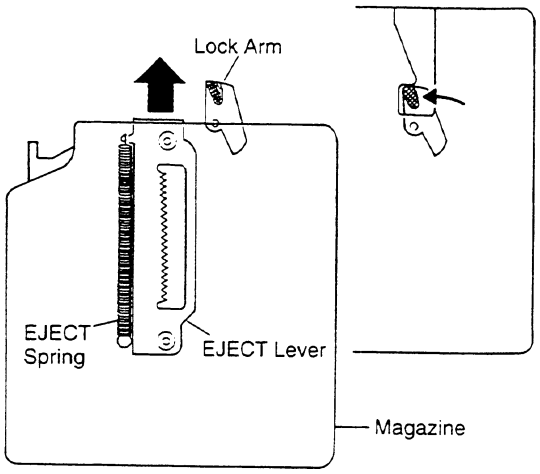


Fig.8

2. The magazine lock is detected when the Sensor Arm moves along the EJECT Lever Cam Section and presses against the MAG Switch (S803) located on the CD Core Unit. Initially, the Sensor Arm is held by the cam section of the EJECT Lever until the Magazine Lock Arm is pushed off by the groove on the reverse side of the magazine. When the Lock Arm is pushed off the cam section is released, but is held again by the Lock Arm. When the magazine lock is released, the Sensor Arm presses the MAG Switch (S803).

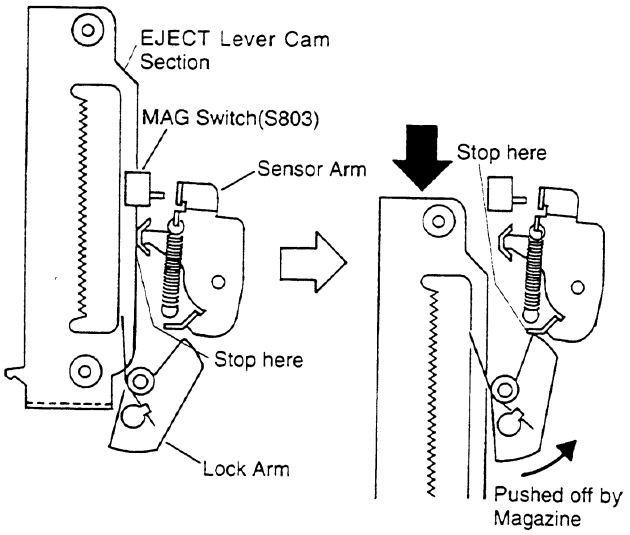


Fig.9

● Elevation Operation

The drive operation is the same as the CX-624, except that there is no motive force cancellation spring. There is a spring which is similar to this spring but its effect is the opposite in function.

● Elevation Detection

When the Rear Lever is driven the Front Lever and Sensor Lever are also driven via the Jointed Arm. The voltage is detected, and drive initiated, when the knob of the Linear Position Sensor (Slide Volume: VR801) enters the U-shaped Groove of the Sensor Lever.

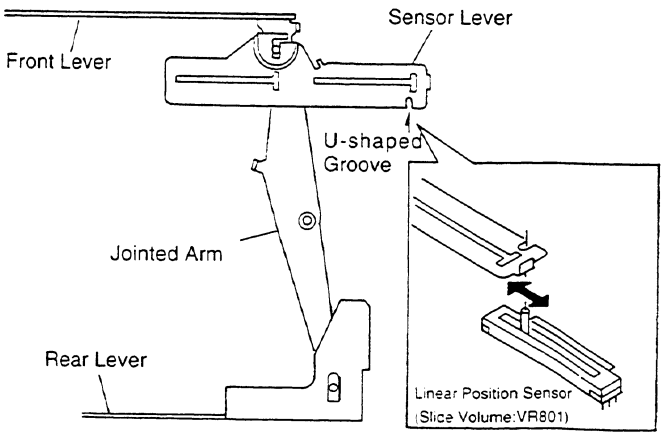


Fig.10

● Operation from the Tray Dispenser to the Clamp

When the Loading Motor drives the Cam Gear, the Tray is pulled out by the Tray Extending Arm which moves along the gear cam, and clamping is performed by sliding the Clamp Lever. During disk loading the Carriage Chassis and Spindle Motor hold positions where they do not get in the way of the Tray. However when the Cam Gear starts to turn (after completion of tray dispension) the Clamp Lever moves and the Shaft of the Carriage Chassis is lifted by the Stepped Holes and the Carriage Chassis is drawn to the Stage Chassis. The Spindle Motor then move to the disk and lifts it from the Tray.

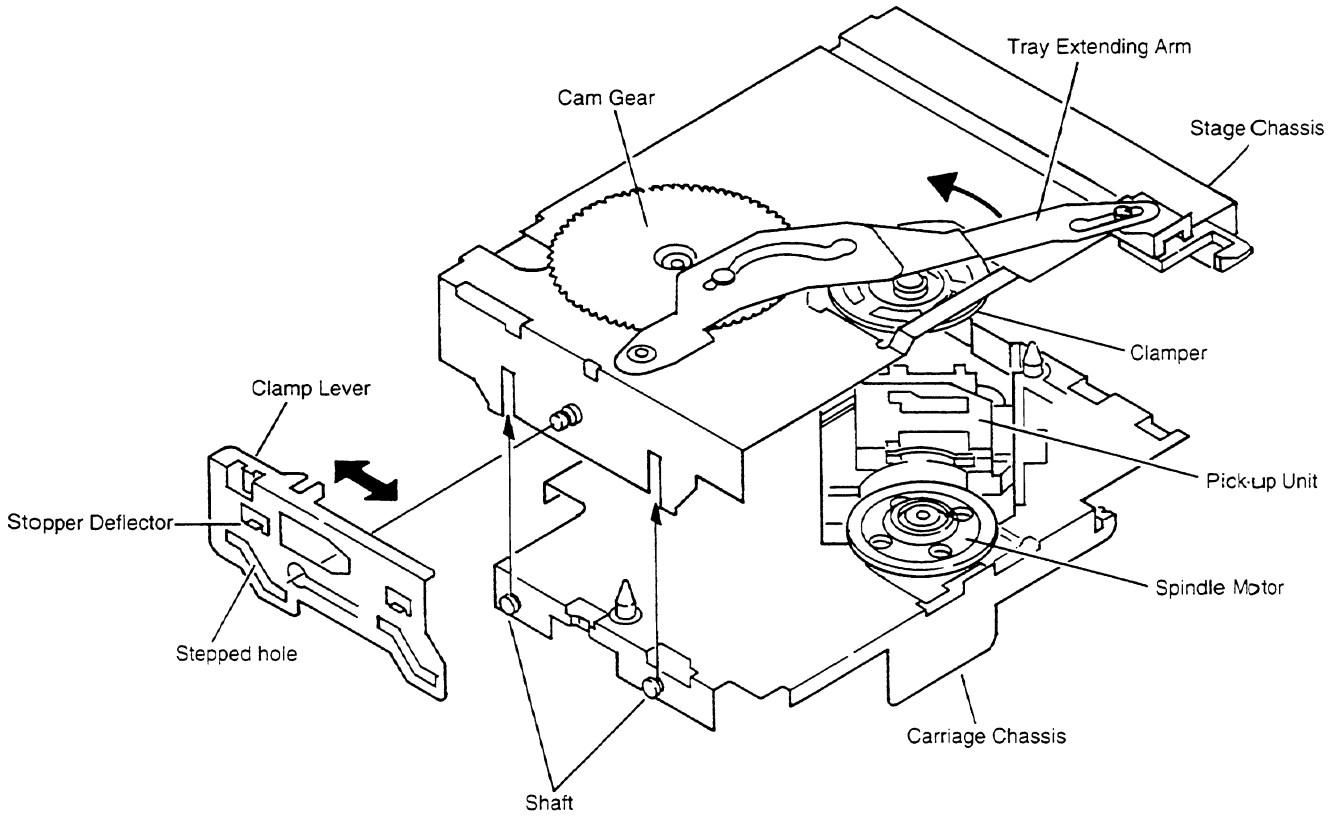


Fig.11

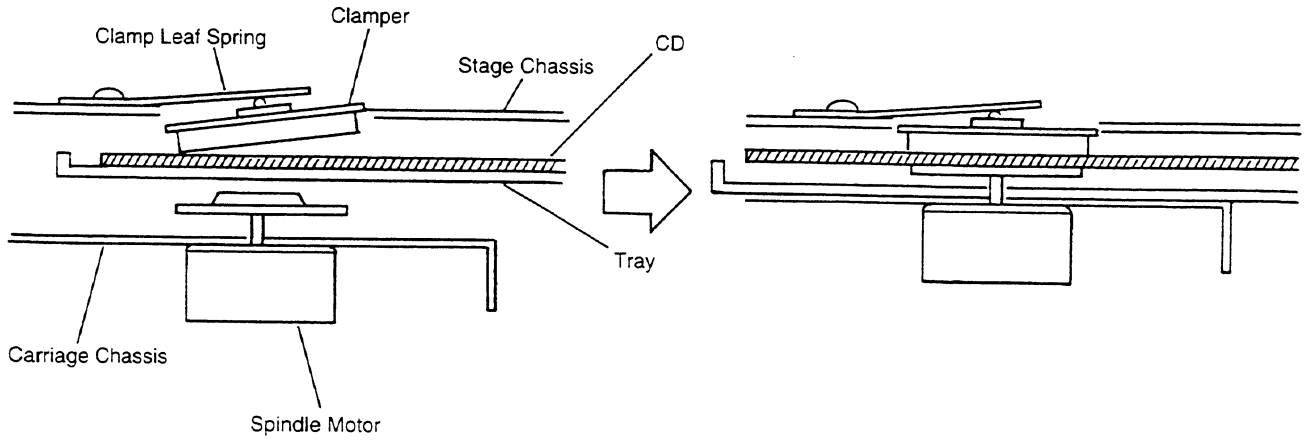
● Stabilizing the Elevation Rattle

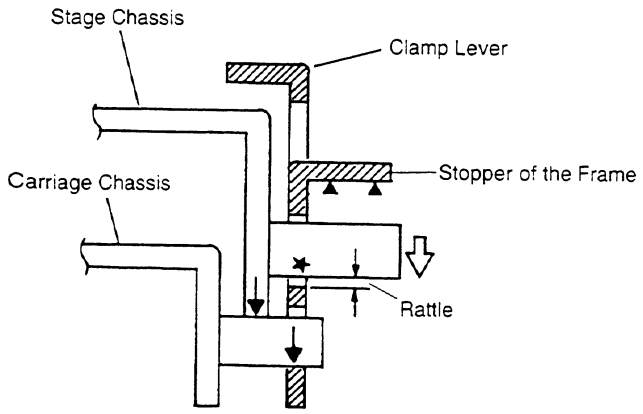
During clamping, the Clamp Lever slides and moves the Carriage Chassis. At the some time, the Stopper of the Clamp Lever enters the Stopper of the Frame, controlling the up and down motion of the stage section.

Due to the elevation structure, the shaft of the Stage Chassis is pushed down and the stage section is stabilized. The Elevation Motor doesn't stop when the lowered position is detected, but a fixed interval after the limit of motion of the structure has been reached.

At this point, if some rattling space as shown in figure 12 is not provided, the shaft of the Stage Chassis pushes on the Clamp Lever directly (marked with ★). No force is transmitted to the Carriage Chassis and rattling occurs, resulting in a deterioration of the anti-vibration characteristics. Therefore, to reduce the rattling at each section an improvement in the anti-vibration characteristics is made by providing enough rattling space to reduce the rattling at each section and ensuring that the force is transmitted in the order of the Stage Chassis → Carriage Chassis → Clamp Lever → Frame.

* The spring of the Jointed Arm is set in such a manner that these relationships do not fall out of place.





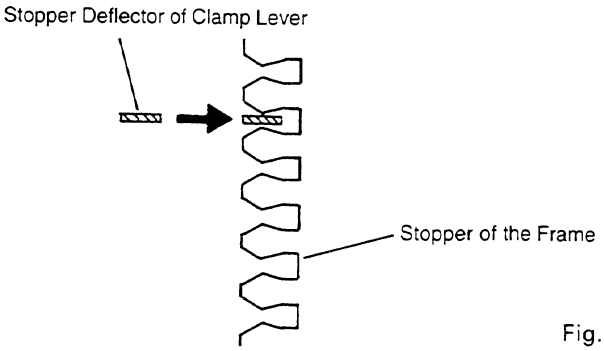


Fig.12

● Disk Detection

DSP Switch (S852) is turned ON and OFF by the DSP Switch Lever driven by the Cam Gear which controls the tray extending motion. The Photo Sensor (Q851, D851) is timed with this ON and OFF status, detecting the existence and non-existence of the disk as well as the type of disk.

● Tray Extension and Retraction Detection

A) Clamp

When the clamp motion of the Clamp Lever is complete the Jointed Arm moves and the protruding section of the arm pushes the TRP Switch (S851) ON via the Leaf Spring.

B) Tray retraction

When the tray retracts the Switch Arm, which operates on the same fulcrum as the Tray Extending Arm, moves and the TRP Switch (S851) is pushed ON by the protruding section of the arm via the Leaf Spring.

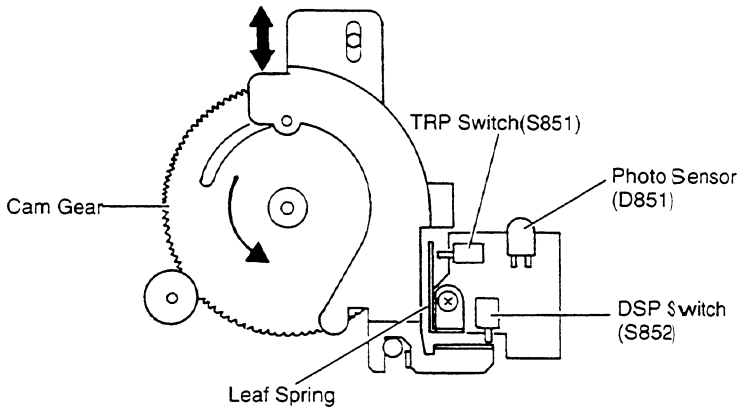


Fig. 13

● Over-extension Prevention Structure of the Tray

In standby mode the Stoppers are maintained in a neutral position by the upper and lower Springs. When the Tray is being dispensed the Stoppers are pushed apart by their Tapers. In this condition, even if an impact force is applied and the Tray is pushed outward, the Tray does not actually get dispensed due to the straight section of the Stopper.
Further, since force F2 of the lower Spring is set smaller that force F1 of the upper Spring (F1>F2) while the Stoppers are being pushed apart, the dispensed Tray is being pushed downward at all times (F=F1-F2), preventing vertical rattling of the Tray due to vibrations.

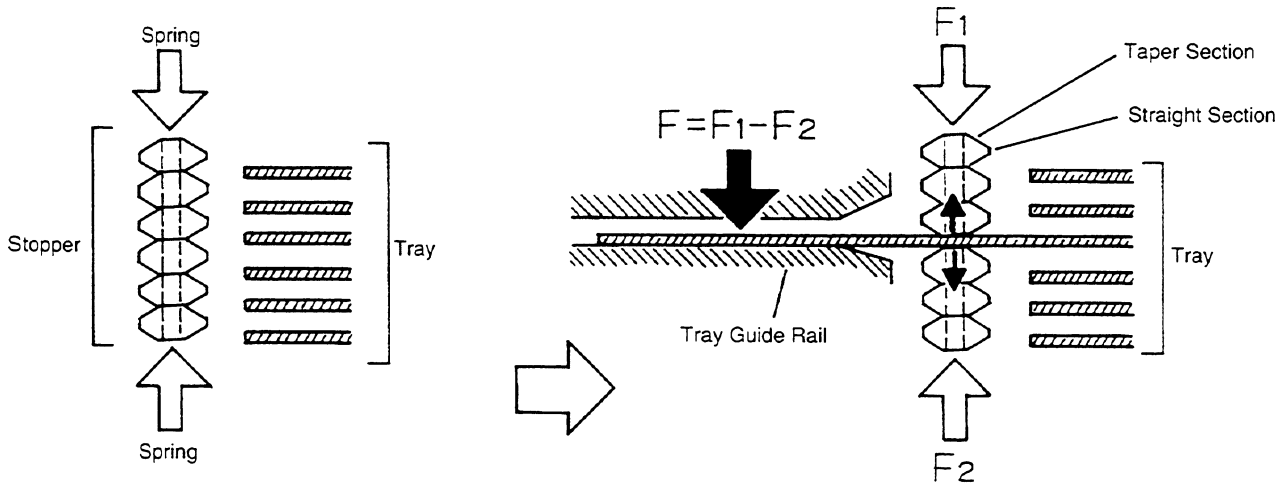


Fig.14

● Magazine Ejection

When the Lever is driven beyond the lowest position of the elevation the bent section of the Rear Lever pushes on the boss of the Lock Arm, releasing the lock. The magazine is ejected by the EJECT Lever.

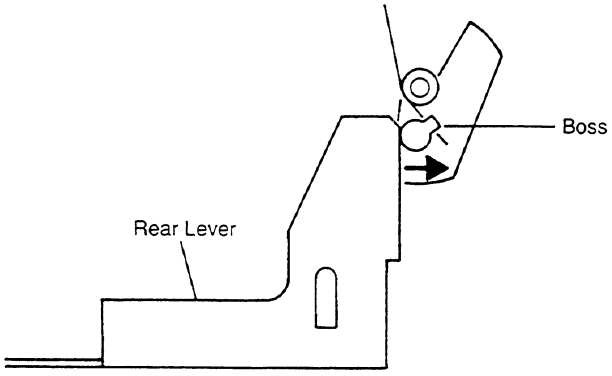


Fig.15

4. CIRCUIT DESCRIPTION

4.1 POWER SUPPLY UNIT CONFIGURATION

The power supply unit of this system consists of 4 power sources, VD(8.6V), 5VA(5V), 5VLR(5V) and VREF(5V).

VD : Main power source. Generated in the expansion board.

5VA : Power source for IC101, IC201 and the Pick-up Unit. Generated by the regulator IC (IC701) from VD.

5VLR : Audio midpoint voltage. Generated by the regulator IC (IC604) from VD.

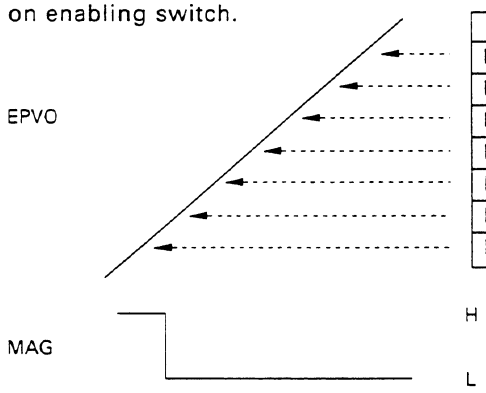
VREF : Power source for Linear Position Sensor. A/D reference voltage of the microcomputer. Usually taken from the microcomputer's VDD line via on enabling switch.

4.2 MECHANISM OPERATION

1) Elevation Operation

The microcomputer determines the present elevation position from the voltage value (EPVO) obtained from the potential divider VR801.

The voltage of the position of the requested disk is calculated from figure 16 and the ELV Motor is controlled so that the EPVO voltage is matched to the value obtained from the calculation.



	min	typ.	max
DISC1 Voltage position	EREF+115LSB	EREF+117LSB	EREF+119LSB
DISC2 Voltage position	EREF+ 76LSB	EREF+ 78LSB	EREF+ 80LSB
DISC3 Voltage position	EREF+ 37LSB	EREF+ 39LSB	EREF+ 41LSB
DISC4 Voltage position	EREF- 2LSB	EREF	EREF+ 2LSB
DISC5 Voltage position	EREF- 41LSB	EREF- 39LSB	EREF- 37LSB
DISC6 Voltage position	EREF- 80LSB	EREF- 78LSB	EREF- 76LSB
EJECT Voltage position			EREF-106LSB

*1LSB = approx 20mV (5/256 V)

Fig.16

2) Tray Extension and Retraction

The microcomputer detects tray retraction, tray extension and clamp completion by the MSW signal waveform (voltage) created by potential division of the voltage DSP Switch and the voltage TRP Switch and controls the Tray Motor.

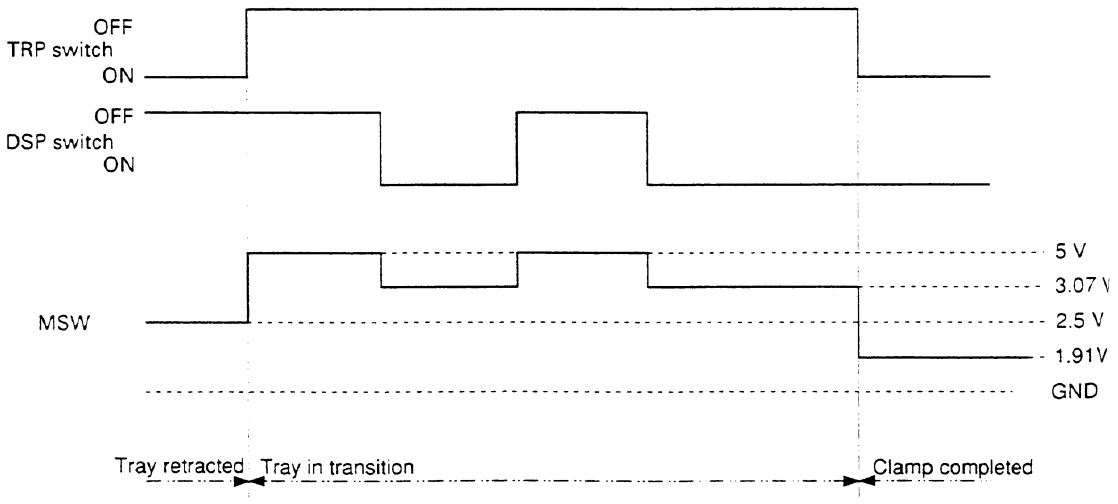


Fig.17

3) 0.6mm UP/DOWN Operation

In order to secure clearance with the neighboring disk the Stage Mechanism is driven down by the ELV Motor (M852) when clamping is complete. The microcomputer detects the completion of clamping, and when the Tray Motor is brought to a full stop, the ELV Motor (M852) is forcibly driven for a 240 ms interval in the downward direction.
When the tray is being retracted, the ELV Motor (M852) is controlled to match the value of EPVO calculated during the elevation operation. The tray retraction operation is started when the Tray has been moved to the prescribed position.

Each motor is driven by the driver IC302(LB1836M). LB1836M is an IC which usually operates through the combination of H and L of the 4 lines I1, I2, I3 and I4. With this system, I1=I3 and control is realized through a combination of H and L of the 3 lines I1, I2 and I4.

ELV Motor	Tray Motor	I1, 3	I2	I4
Forward	Brake	H	H	L
Reverse	Stand-by	L	L	H
Brake	Forward	H	L	H
Stand-by	Reverse	L	H	L
Brake	Brake	H	H	H
Stand-by	Stand-by	L	L	L

* ELV Motor Forward : ELV-up (Disc No. Down)
Tray Motor Forward : Tray Ejection

4) Disc Detection

The MSW signal is not only used for the timing of the disk extension and retraction motion but also for determinating the existence and non-existence of a disk and the disk type (8cm or 12cm). The disk detection operations are carried out while the Tray is being pulled out of the magazine. Disk detection is determined when the light passes through (DISC waveform L:less than 1.5V) or is interrupted (DISC waveform H:1.5V or above) with an array of LEDs and photo transistors above and below the Tray.

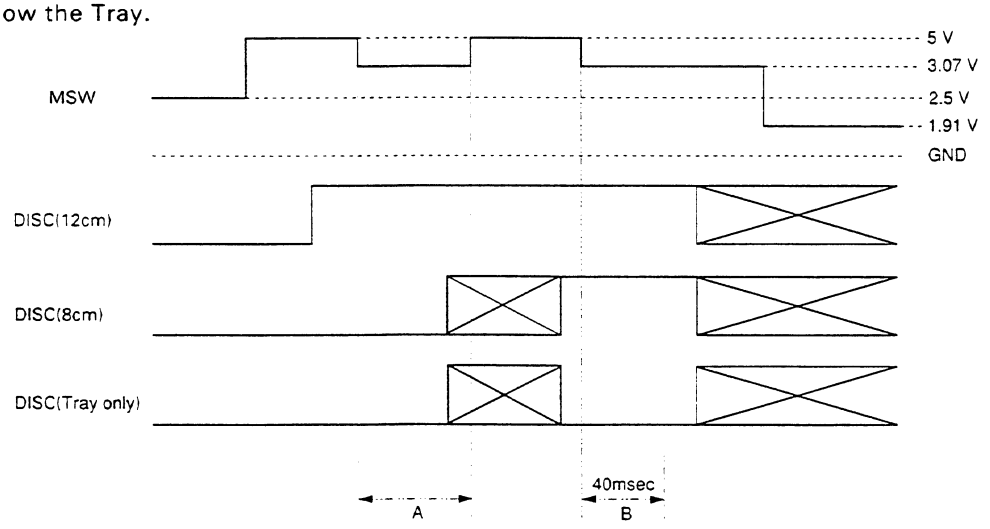


Fig.18

The DISC waveform is continuously monitored within the intervals A and B above and if a L is detected even once, that interval is determined as L. If a L is not detected at all then that interval is determined as H in the following.

	A	B
12cm	H	H
8cm	L	H
No Disk	—	L

4.3 PRE-AMP SECTION (UPC2572GS: IC101)

This section processes the pickup output signals to create the signals for the servo, demodulator & control.

The pickup output signals are I-V converted by the pre-amp with built in photo-detector in the pickup, and added by the RF amp (IC101) to obtain the RF, FE, TE, TE zero cross, and other signals.

The main component is the UPC2572GS and each section is explained below. Because this system has a single power supply (+5V), the reference voltage for this IC, the PU and the servo circuit is the voltage REFO (+2.5V). The REFO signal is obtained by buffering REFOUT from the servo LSI (IC201: UPD63702GF) and is available from Pin 19 of IC101. All measurements should be done using this REFO as reference.

Note: During measurement, do not short REFO and GND.

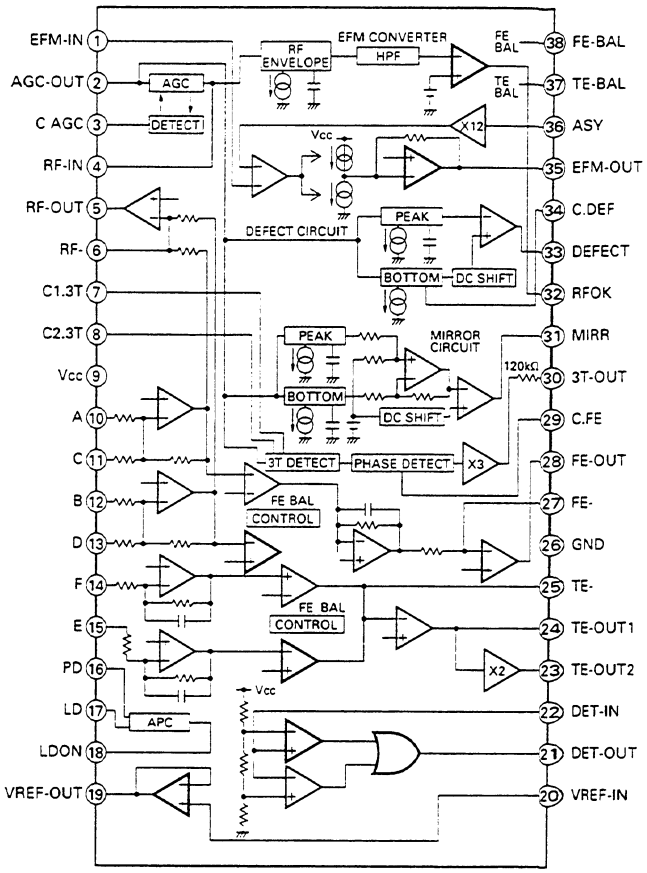


Fig.19 : UPC2572GS BLOCK DIAGRAM

1) APC Circuit (Automatic Power Control)

When the laser diode is driven with constant current, the optical output has large negative temperature characteristics. So the current must be controlled to hold the output constant with the monitor diode. The circuit that carries out this function is the APC circuit. The LD current is obtained by measuring the voltage between LD1 and ground and the value of this current is about 35mA.

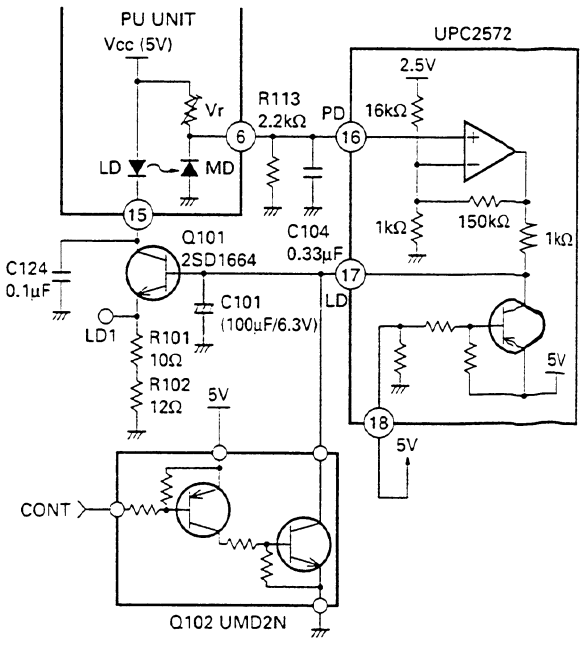


Fig.20 : APC CIRCUIT

2) RF Amp, RF AGC Amp

The photo-detector outputs (A+C) and (B+D) are added, amplified, and equalized in IC101 and output to the RFI pin. (The eye pattern can be checked at this pin.)

The RFI voltage low-frequency component is:

RFI = (A+B+C+D) × 3.22

R111 is the offset resistor for holding the RFI signal in the pre-amp's output range. The RFI signal is AC coupled and input to Pin 4 (RFIN pin).

This IC contains an RF AGC circuit, which holds the RFO output at Pin 2 at a fixed level (1.2 ± 0.2Vp-p). This RFO signal is used in the EFM, DFCT, and MIRR circuits.

3) EFM Circuit

This circuit, "squares" up the analog RF signal into a digital EFM signal. In order to ensure minimum errors it is necessary to use a feedback circuit to match the DC level of the threshold to the center of the RF waveform.

This circuit uses the fact that the EFM signal should have no DC component. By feeding back the EFM signal's DC level the threshold level changes until the DC level is zero and the threshold, by definition, is at the exact center of the RFO waveform. The filtering in the feedback has been adjusted to ensure minimum error. The EFM signal is output from Pin 35. The signal is a 2.5Vp-p amplitude signal centering on REFO.

4) DFCT (Defect) Circuit

The DFCT circuit detects defects on the disc surface, and outputs a "H" signal from Pin 33.

If there is dirt on the disc, drop outs may appear. The DFCT signal output is input to the servo LSI HOLD pin and the focus and tracking servo drives are held while the DFCT output is "H" in order to improve playability.

5) RFOK Circuit

This circuit produces the signal indicating the focus close state during play and the timing for closing the focus servo. This signal is output from Pin 32. This RFOK signal output is input to the servo LSI RFOK pin and the focus close command is issued by the servo LSI. This signal is high during play when the focus is closed.

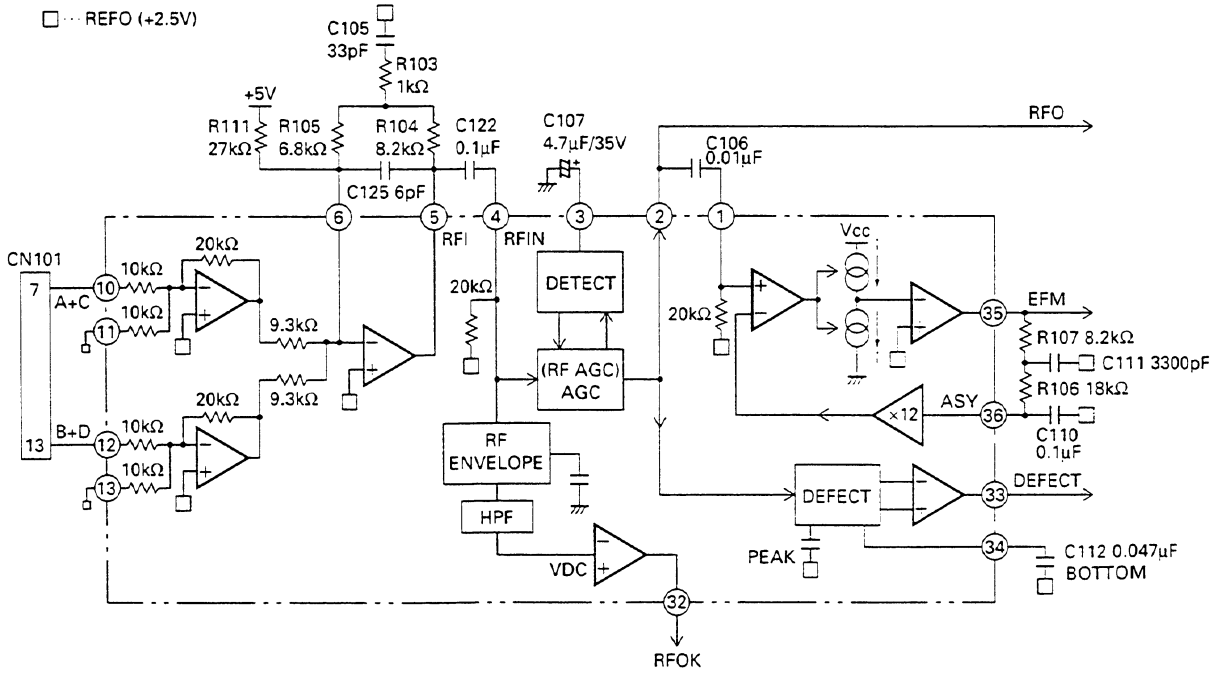


Fig.21 : RF AMP, RF AGC, EFM, DFCT, RFOK CIRCUIT

6) Focus Error Amp

The photo-detector outputs (A+C) and (B+D) are passed through a differential amp, and an error amp and (A+C-B-D) is output from Pin 28 as the FE signal.
The FEY voltage low-frequency component is:

$$FEY = (A+C-B-D) \times \frac{20k}{10k} \times \frac{90k}{68.8k} \times \frac{R108}{17.2k}$$

: (PU FE level x 5.02)

An S curve of about 1.6Vp-p is obtained with REFO as the reference. The final-stage amp cutoff frequency is 12.4kHz.

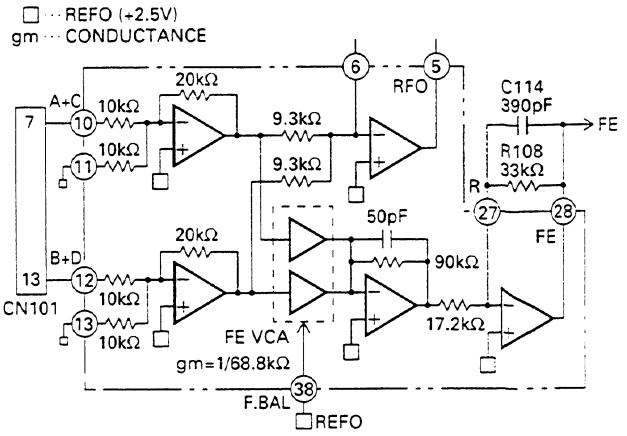


Fig.22 : FOCUS ERROR AMPLIFIER

7) Tracking Error Amp

The photo-detector E and F outputs are passed through a differential amp and an error amp and (E-F) is output from Pin 24 as the TE signal.
The TEY voltage low-frequency component is:

$$TEY = (E-F) \times \frac{63k}{(31k + 16k)} \times \frac{R109}{17k}$$

: (PU TE output level x 5.36)

The TE waveform of about 1.5Vp-p with REFO as the reference is obtained as the TE output (Pin 24). The final-stage amp cutoff frequency is 19.5kHz.

8) Tracking Zero Crossing Amp

The tracking zero crossing signal (below, TEC signal) is the TE waveform (Pin 24 voltage) amplified four times and is used to find the zero crossing points of the tracking error with the UPD63702GF servo LSI. This zero crossing point is found for the following two reasons.

(1) To count tracks for carriage moves and track jumps

(2) To detect the direction in which the lens is moving for tracking closing (This is used in the tracking brake circuit, described Page 20 b).)

The TEC signal frequency range is 500Hz - 19.5kHz.

TEC voltage = TE level x 4

In other words, the TEC signal level is calculated at 6Vp-p. This level exceeds the op-amp's output range and the signal is clipped, but this can be ignored because this signal is used by the servo LSI only at the zero crossing point.

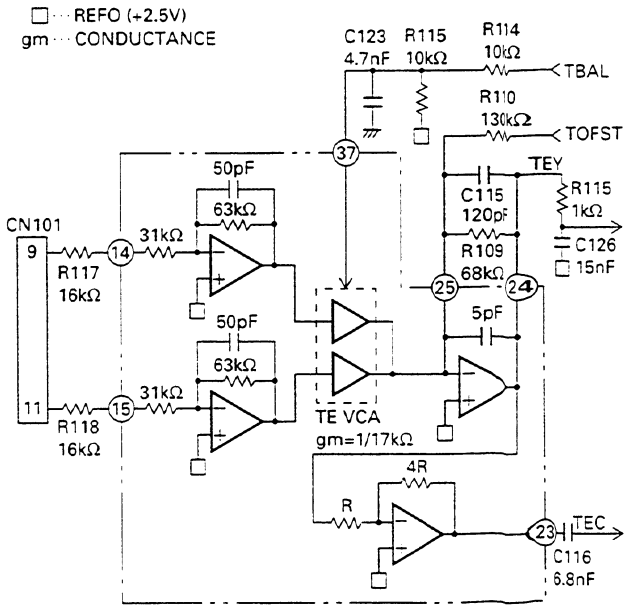


Fig.23 : TRACKING ERROR AMPLIFIER & TRACKING ZERO CROSSING AMPLIFIER

9) MIRR (Mirror) Circuit

The MIRR signal shows the on track and off track data and is output from Pin 31.

When the laser beam is

On track: MIRR = "L"

Off track: MIRR = "H"

This signal is used in the brake circuit, described Page 20.

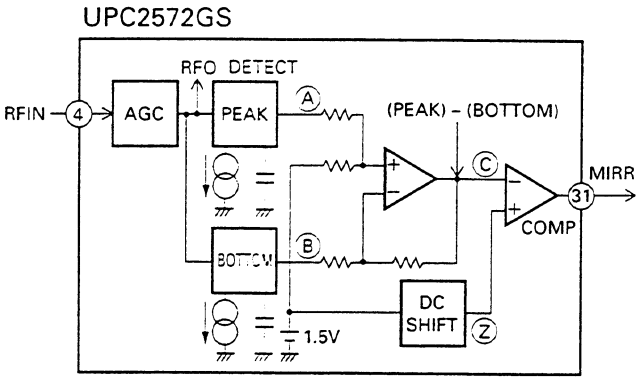


Fig.24 : MIRR CIRCUIT

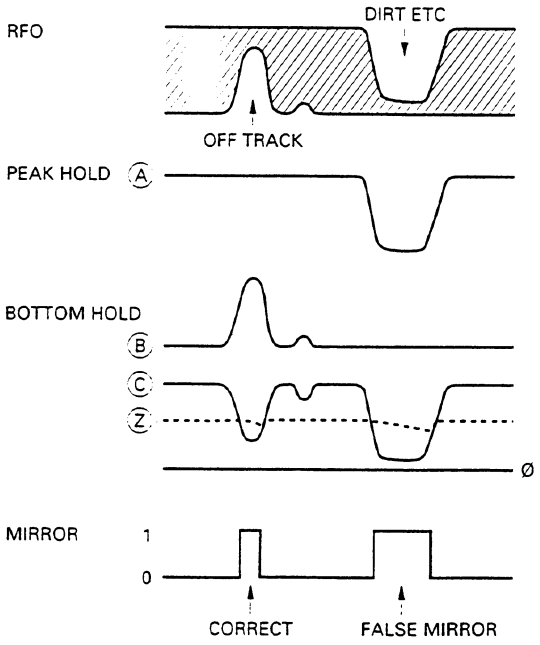


Fig.25 : MIRR CIRCUIT & SIGNAL DIAGRAM

10) 3TOUT Circuit

This circuit detects variations of the RF signal when an external interference is input into the focus servo loop and outputs the phase difference between the FE signal and the RF level variation signal from Pin 30. The signal has been passed through a low-pass filter (fc = 40Hz). This signal is used for the FE bias automatic adjustment, described Page 23.

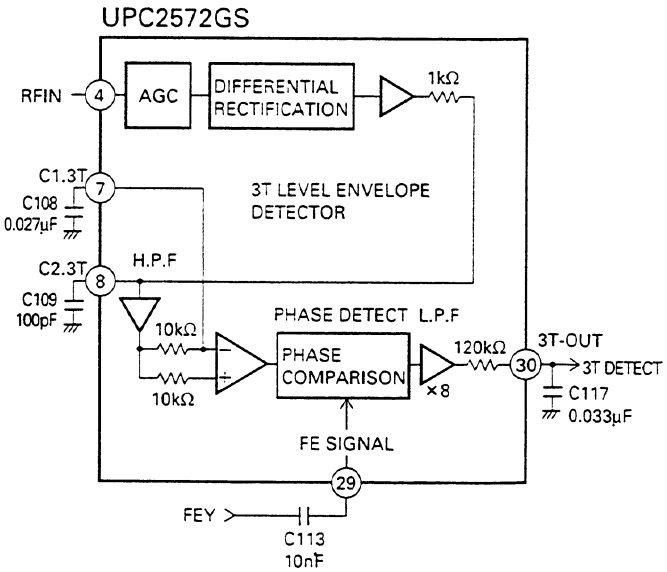


Fig.26 : 3T OUT CIRCUIT

4.4 SERVO SECTION (UPD63702GF: IC201)

This section can be divided into two parts.
One is the servo processing section, which handles such servo controls as error signal equalizing, in focus, track jump, and carriage move. The other is the signal processing section, which handles data decoding, error correction, and interpolation processing.
This IC converts the FE and TE signals from analog to digital and outputs the focus, tracking, and carriage drive signals via the servo block. Also, the EFM signal from the pre-amp is decoded in the signal processing section and finally output as audio signals after D/A conversion. (This IC has a built in audio digital-analog converter.) The decoding process also creates the spindle servo error signals, which is fed to the spindle servo block to create the spindle drive signal.
The focus, tracking, carriage, and spindle drive signals are then amplified by IC301, XLA6997FM and fed to their respective actuators and motors.

1) Focus Servo System

The main focus servo equalizer is in the UPD63702GF. Figure 27 is the focus servo block diagram.
In the focus servo system, the lens must be brought within the in-focus range for focus closing. Therefore, the lens is raised and lowered according to the triangular focus search voltage to find the focus point. During this time the spindle motor is kicked and kept rotating at a set speed.
The servo LSI monitors the FE signal and the RFOK signal and automatically carries out the focus close operation at the appropriate point.
Focus closing is carried out when the following four conditions are all met.

(1) The lens is moving from far to near toward the disc surface.
(2) RFOK = H
(3) The FZD signal (within the IC) is latched at high.
(4) FE = 0 (REFO reference)

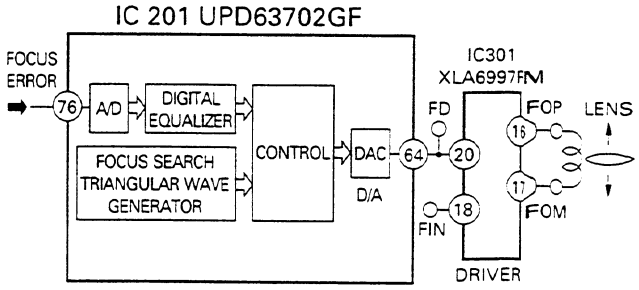


Fig.27 : FOCUS SERVO BLOCK DIAGRAM

When the above conditions are all met and the focus is closed, the XSO signal is shifted from high to low, then 40ms later, the microcomputer begins to monitor the RFOK signal that is passed through the low pass filter.
When the RFOK signal is judged to be low, the microcomputer carries out various actions such as protection.
Figure 28 shows the series of operations for focus closing (for the case where focus cannot be closed.) Also, in focus-mode-selection during test mode when the display is 01, if the focus close button is pressed, the S curve, search voltage, and actual lens movements can be checked.

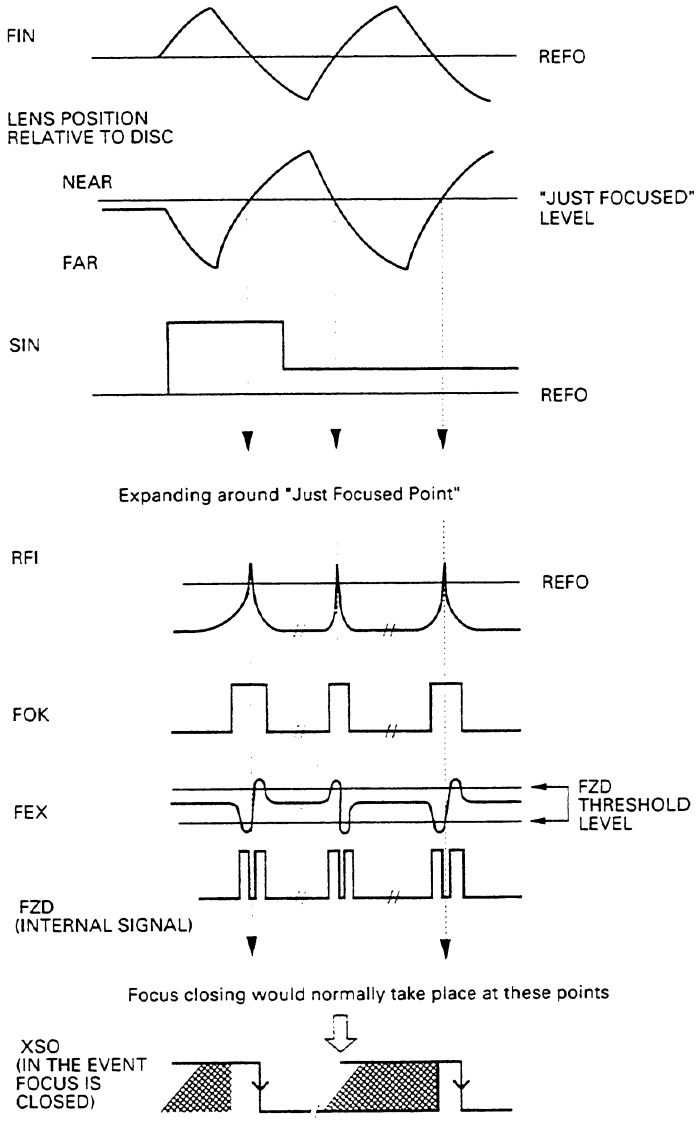


Fig.28: FOCUS CLOSING SEQUENCE

2) Tracking Servo System

The main tracking servo equalizer is in the UPD63702GF. Figure 29 is the tracking servo block diagram.

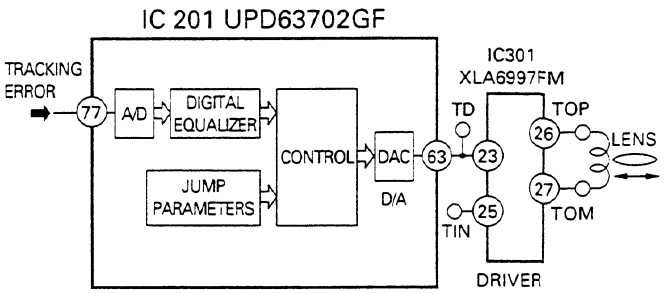


Fig.29 : TRACKING SERVO BLOCK DIAGRAM

a) Track Jump

When the LSI receives the track jump command from the microcomputer, the track jump is carried out automatically by the auto sequence function within the LSI. This system has six types of track jumps used for searches: 1, 4, 10, 32, 32 × 2, and 32 × 3. In test mode, in addition to these jumps, CRG moves can be executed and checked by mode selection. For track jumps, the microcomputer sets half of the total number of jumps (2 tracks for a 4 track jump) and counts the set number of tracks using the TEC signals. From the point when it has counted the set number of tracks, it outputs the brake pulse for a fixed period of time (set by the microcomputer) to stop the lens. In this way, it can close the tracking and continue normal play.

To improve the servo loop re-closing performance just after track jump, the brake circuit comes on for 60ms after the end of the brake pulse and the tracking servo gain is increased.

Fast forward and reverse operations in normal mode are realized by executing consecutive single track jumps. The speed is about 10 times as high as in normal play.

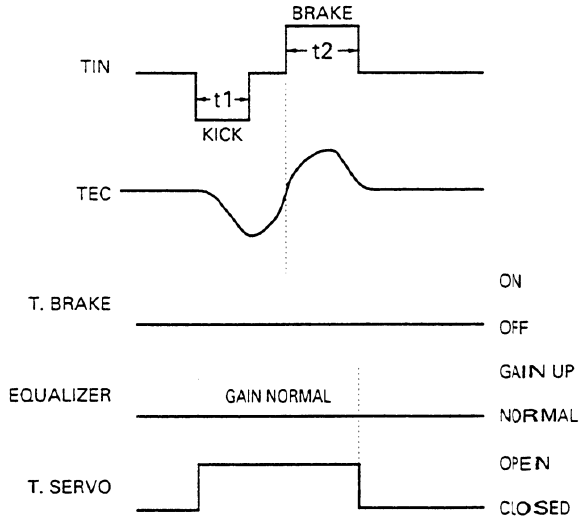


Fig.30 : SINGLE TRACK JUMP

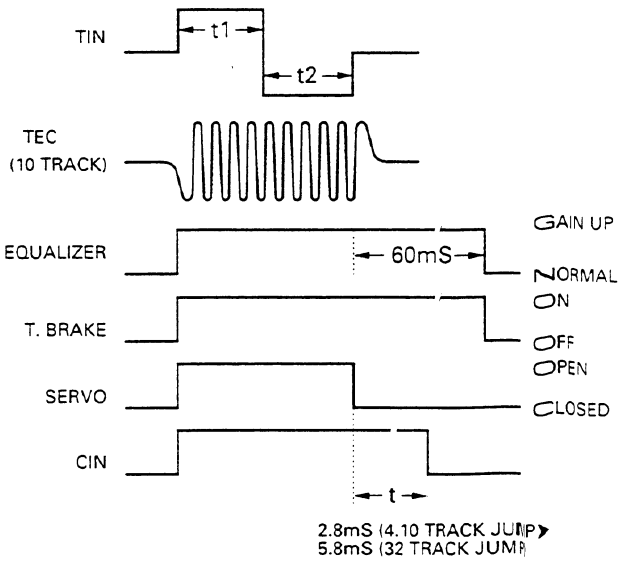
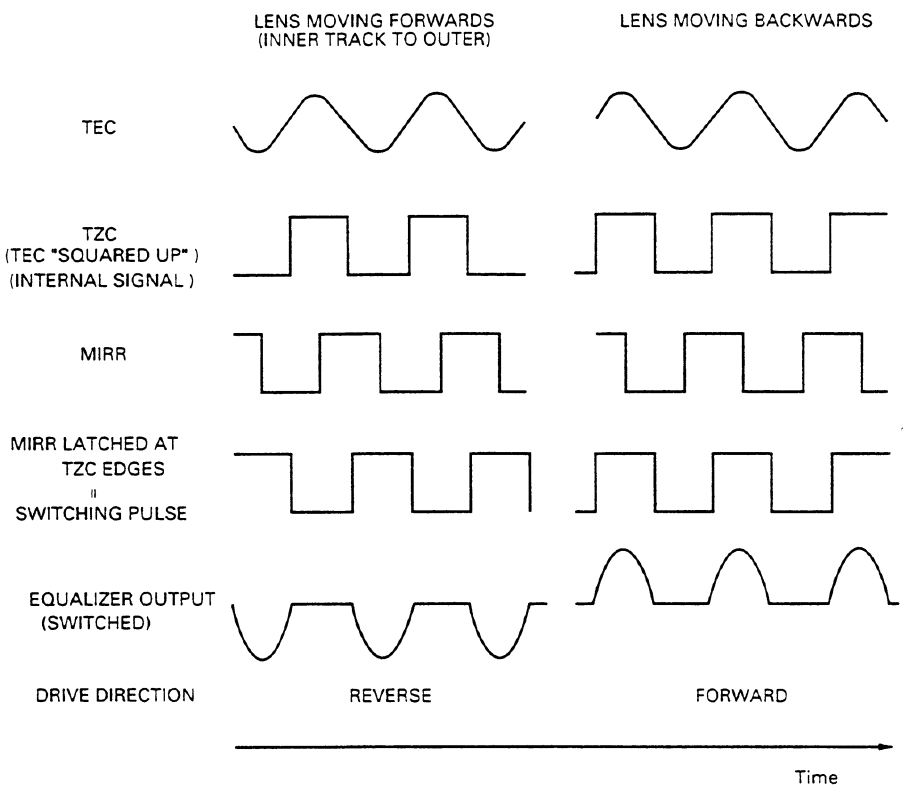


Fig.31 : MULTI-TRACK JUMP

b) Brake Circuit
This relies on determining which direction the lens is moving and only outputting the portion of the drive waveform which acts to oppose this motion. Direction of motion is deduced from TEC and the MIRR signal and knowledge of their phase relation.



Note: Equalizer output assumed to hava same phase as TEC.

Fig.32 : TRACKING BRAKE CIRCUIT

3) Carriage Servo System

The carriage servo supplies the tracking equalizer's low-frequency component (lens position information) output to the carriage equalizer and after applying a fixed amount of gain, outputs the drive signal from the servo LSI. This signal is applied to the carriage motor through the driver IC.

When the lens offset reaches a certain level during play, the entire PU must be moved in the forward direction. Therefore, the equalizer gain is adjusted to output a voltage higher than the carriage motor starting voltage. In actual operations, a certain threshold level is set for the equalizer output within the servo LSI and the drive voltage is output from the servo LSI only when the equalizer output level exceeds that threshold level. This reduces power consumption. Also, due to disc eccentricity and other factors, the equalizer output voltage may cross the threshold level a number of times before the entire PU starts to move. In this case, the drive voltage waveform, (which is applied) from the LSI, becomes pulsative.

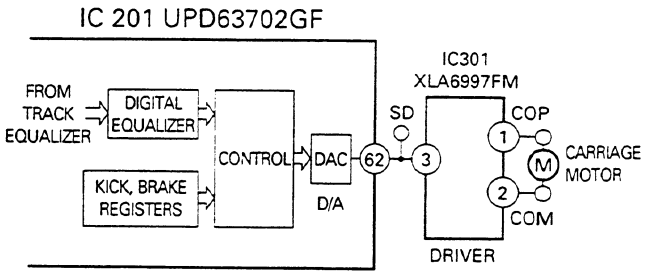


Fig.33 : CARRIAGE SERVO CIRCUIT

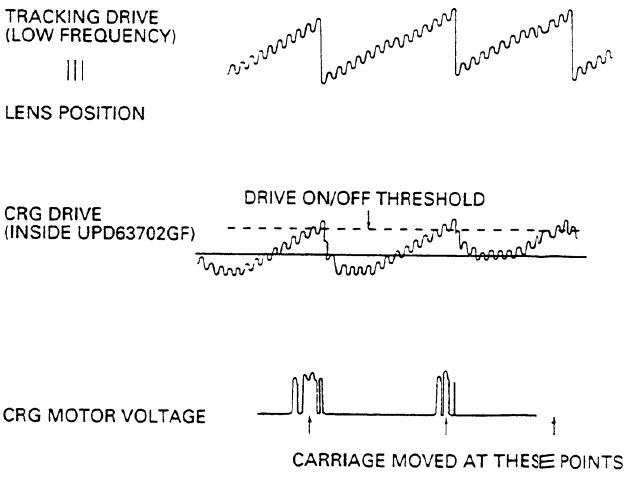


Fig.34 : CARRIAGE WAVEFORM

4) Spindle Servo System

The spindle servo has the following modes.

(1) Kick: The mode used for disc rotation acceleration during setup

(2) Offset:

a) Used during setup from the end of kick until the AGC end

b) Used during play when the focus is unlocked until it is recovered

Both of these are for holding the disc rotation rate near the normal rotation rate.

(3) Adaptive servo: CLV servo mode for normal operation

In the EFM demodulation block, the frame sync signal and internal frame counter output signal are sampled each WFCK/16 and a signal is produced indicating whether or not they match. Only after this signal is in non-match mode eight consecutive times, is the system treated as out of sync, at other times it is treated as in sync. In this adaptive servo mode, a servo mode for pulling the system into sync is automatically selected when the system is out of sync and the regular servo is automatically selected when the system is in sync.

(4) Brake: The mode for stopping the spindle motor rotation

The brake voltage is output by the microcomputer from the servo LSI. At this time, the EFM wave form is monitored within the LSI and if the longest EFM pattern exceeds a certain interval (when the rotation is slow enough), a flag is registered within the LSI and the microcomputer switches the brake voltage off. If the flag is not registered within a certain period of time, the microcomputer switches from brake mode to stop mode which lasts for a fixed period of time. In this case, ejection of the disc can only occur after this period of time.

(5) Stop: The mode used during power on and ejection

At this time, the voltage across the spindle motor is 0V.

(6) Rough servo: The mode used for carriage feed (carriage move during a long search)

The linear speed is calculated from the EFM wave form and a high level or low level is input to the spindle equalizer. In test mode, this mode is also used for the grating check.

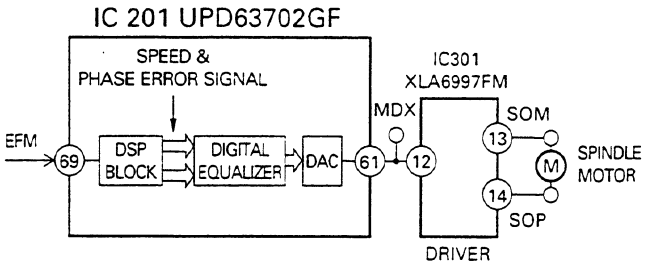


Fig.35 : SPINDLE SERVO BLOCK DIAGRAM

4.5 AUTOMATIC ADJUSTMENT FUNCTIONS

This system uses a pre-amp (UPD2572GS) and servo LSI (UPD63702GF) to automate all circuit adjustment. All adjustments are carried out automatically each time a disc is inserted or the CD mode is selected with the source key. Here is how each automatic adjustment works.

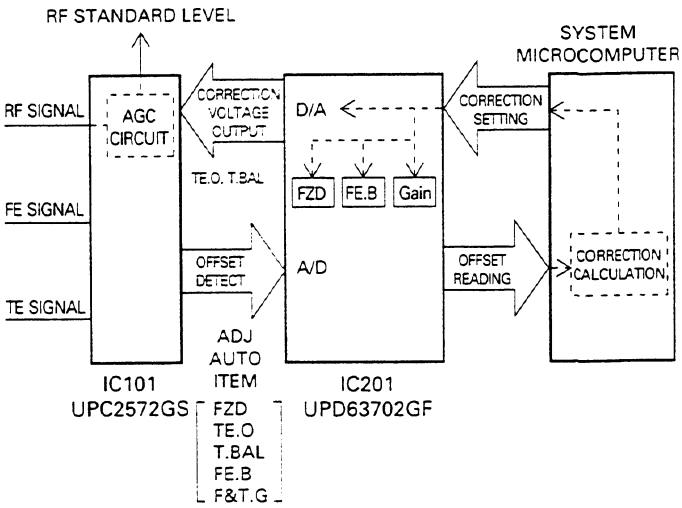


Fig.36 : AUTOMATIC GAIN CONTROL

1) FZD Cancel Setting

This setting is to make the focus closing reliable. When the power is switched on, the FE offset level is read and a voltage opposite to this offset value is written to the CRAM in the IC to cancel the offset. In this way, the FZD threshold level can be set to a constant value (+150mV) and one of the conditions within the IC for focus closing "that the FZD signal is latched at high" can be fulfilled reliably.

2) TE Offset Automatic Adjustment

This function adjusts the pre-amp TE amp offset to 0 V when the power is switched on.

The adjustment procedure is:

(1) The TE offset (LD off) is read by the microcomputer via the servo LSI (offset = TE1).

(2) The microcomputer calculates the voltage to be corrected from the value of TE1 and sets the output of Pin 65 of the servo LSI (signal name: TOFST). The concrete calculation method is as follows.

TOFST2 = TOFST1 + TE1 × R110/R109

3) Tracking Balance Automatic Adjustment

This adjustment equalizes the difference in sensitivity of the E channel and F channel of the TE output. In actual practice, the TE waveform is adjusted to be vertically symmetrical about REFO.

The adjustment procedure is:

(1) After focus closing, the lens is kicked in the radial direction to reliably generate the TE waveform.

(2) At this time, the microcomputer reads the peak and bottom of the TE waveform through the servo LSI.

(3) The microcomputer calculates the value of the offset and the correction voltage to output from Pin 66 of the servo LSI (signal name: TBAL).

(4) The voltage output from the servo LSI is input to Pin 37 of the pre-amp (IC101: UPC2572). This pin is the TEVCA amp control voltage pin. The gain for the E channel and F channel within the pre-amp is varied according to the input voltage to adjust the tracking balance and make the TE waveform vertically symmetrical about REFO.

4) FE Bias Automatic Adjustment

This adjustment is made to maximize the RFI level during play by optimizing the focus point. This adjustment utilizes the phase difference between the RF waveform 3T level signal and the focus error signal. Since an external interference is input into the focus loop, this adjustment uses the same timing as the auto gain control, explained below.

The adjustment procedure is:

(1) External interference is injected into the focus loop by command from the microcomputer (within the servo LSI).

(2) The RF signal 3T component level variation is detected within the pre-amp.

(3) The phase difference between the FE signal due to external interference input and the above 3T component is detected, to sense the focus deviation direction, and the result is output as a DC voltage from Pin 30 (3T-OUT) of the pre-amp.

(4) The 3T-OUT voltage is input to Pin 75 (A/D port) of the servo LSI and the microcomputer reads the 3T-OUT voltage through the servo LSI.
(5) The microcomputer calculates the required correction and adjusts the focus loop offset in the servo LSI.

In the same manner as the auto gain control, this adjustment is repeated a number of times to raise the adjustment precision.

5) Auto Gain Control (AGC)

This adjustment has already been used in the previous generation of CD modules. This function automatically adjusts the focus and tracking servo loop gain.

The adjustment procedure is:

(1) External interference is injected into the servo loop.
(2) The error signals (FE, TE) when the external interference is injected are passed through a band pass filter and the G1 and G2 signals are obtained.
(3) The microcomputer reads the G1 and G2 signals through the servo LSI.
(4) The microcomputer calculates the required correction and adjusts the loop gain within the servo LSI.

To raise the adjustment precision, the same adjustment procedure is repeated a number of times.

6) Initial Adjustment Values

All the automatic adjustments use the previous adjustment value as the initial value as long as the microcomputer power supply is not cut off (the backup is not cut off). If the backup is cut off, automatic adjustment does not start from the previous adjustment value, but rather from the default setting.

7) The Coefficient Display for Adjustment Result

The results of all automatic adjustments can be displayed and checked in test mode.

The coefficient displays for each automatic adjustment are as follows.

(1) FZD cancel, TE.OFST cancel, T.BAL, FE.bias
Reference value = 32 (A coefficient of 32 indicates that no adjustment was necessary).
The display is in units of about 40mV.
Example: FZD cancel coefficient = 35
35-32 = 3 3 x 40mV = 120mV
Since the corrected value is approximately + 120mV, the FE offset before adjustment was - 120mV.

(2) Focus and tracking gain adjustment
Reference value: Focus = 13, tracking = 20
The coefficient display shows the gain derease relative to the reference value.
Example: AGC coefficient = 40
Gain = 20log (20/40) = - 6dB